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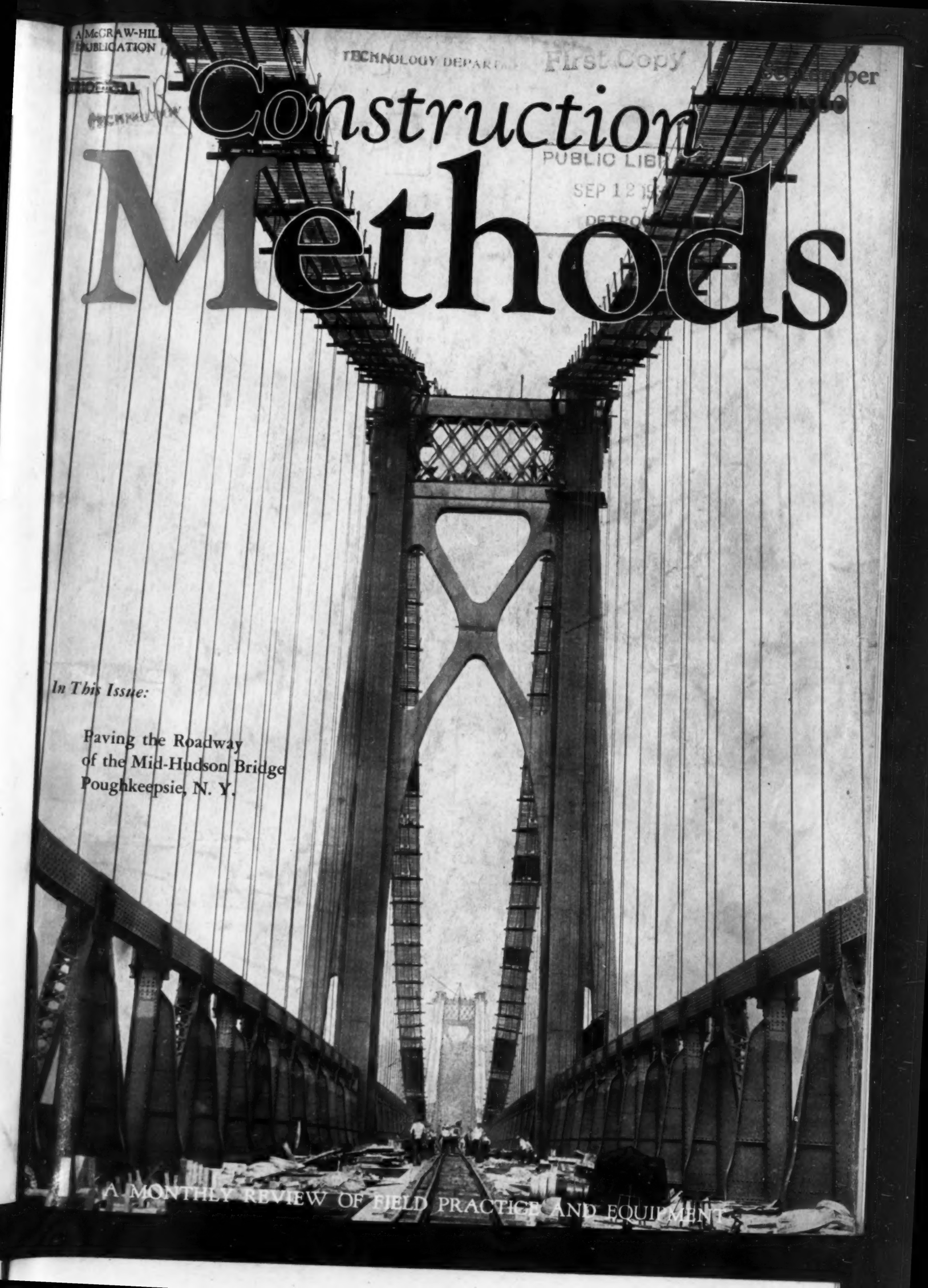
Construction Methods



In This Issue:

Paving the Roadway
of the Mid-Hudson Bridge
Poughkeepsie, N. Y.

A MONTHLY REVIEW OF FIELD PRACTICE AND EQUIPMENT

Cost Cutters

The superior performance of I-R "Jackhamer" Drills and Portable Compressors has lead to their adoption by a great many contractors and public utility companies throughout the world.

These outfits are powerful, well-constructed, and thoroughly reliable; they speed operations and lower costs under all working conditions.

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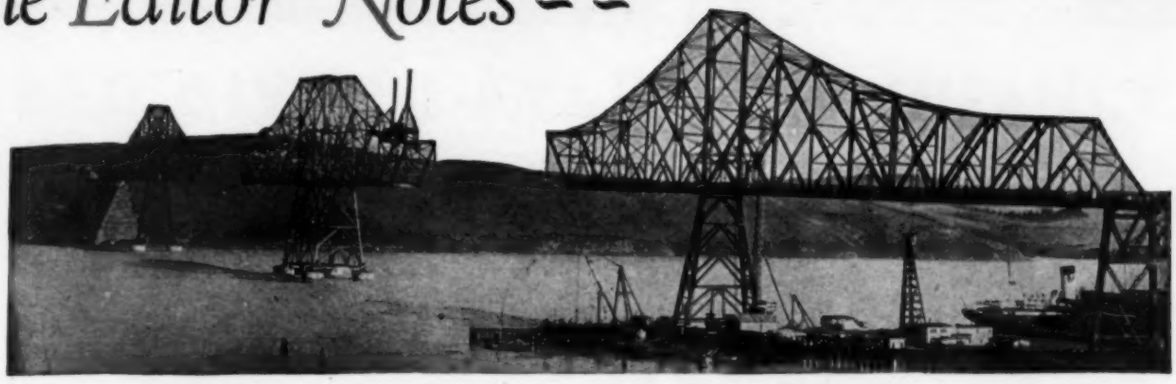
TECHNOLOGY DEPT.

CONSTRUCTION METHODS, September, 1930. Vol. 12, No. 9. Published monthly. McGraw-Hill Publishing Company, Inc., Tenth Avenue at Thirty-sixth Street, New York, N. Y. $1 per year; 10 cents per copy. Entered as second-class matter, October, 1926 issue. Vol. 8, No. 19, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

The Editor Notes - -



Road Building for Drought Relief

RELIEF for those states affected by the recent drought is assured by the action of Secretary of Agriculture Hyde last month in authorizing the immediate apportionment of $121,875,000 of federal funds for highway improvement for the next fiscal year. Ordinarily the funds would not be allocated until Jan. 1, 1931. This acceleration of the road-building programs is intended to provide employment for farmers whose crops have been destroyed by lack of rain. Following the established federal-aid highway procedure the federal funds for road building must be matched by equal sums appropriated by the several states. On Aug. 1 of this year $65,256,000 of federal money was available for matching by state funds; all of that amount can be disbursed immediately. Although the $121,875,000 authorized for allocation can not be disbursed prior to Jan. 1, the states are permitted to let construction contracts in advance. With the cooperation of the states in the afflicted areas, therefore, a speeding up of the highway construction program will help solve the problem of unemployment due to the drought.

◆

To Determine Job Costs

An accurate and detailed knowledge of costs is the foundation upon which any successful construction organization must be built. Without it, construction ceases to be a business and becomes a "game." Most of the larger construction companies have developed systems of cost analysis and accounting that remove their bids or estimates from the category of mere gambles. Not so, the medium-size and small contractors. Skilled in the technique of field operations, they are often woefully deficient in the office administration end of their business. To men of this class is recommended the compact yet comprehensive cost form reproduced on p. 37 of this issue. It emphasizes the fact, frequently ignored by the irresponsible, price-cutting bidder, that the actual cost of the job includes more than labor and materials. Just as important as these are the items listed under the heads of fixed, current, administrative, general and financial expense. A more general realization that these are decidedly real, rather than fanciful, items of cost would go a long way toward lowering the financial mortality in the construction business.

CONSTRUCTION METHODS

A monthly review of modern construction practice and equipment

ROBERT K. TOMLIN, *Editor*

Editorial Staff

VINCENT B. SMITH NELLE FITZGERALD

J. I. BALLARD (San Francisco)

WILLARD CHEVALIER, *Publishing Director*

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Tenth Avenue at 36th Street, New York

◆

Treated Lumber at Retail

Important economies in the upkeep of houses and other types of wood construction may be effected by the use of chemically treated lumber, says Axel H. Oxholm, director of the National Committee on Wood Utilization of the Department of Commerce. In an endeavor to give home builders the benefit of economies such as the railroads effect in using treated ties the committee has induced retail lumber dealers to stock chemically treated lumber, so that it might be available in small quantities to the average consumer. Treated lumber to prolong the life of certain parts of a building is now procurable in retail quantities throughout the state of Ohio and the committee is planning the extension of the treated wood project to other states.

◆

New Uses of Aluminum in Building

ANNOUNCEMENT last month that the new $20,000,000 New England building in Boston would be topped with an aluminum dome and that this metal would be used extensively to obtain special decorative effect again calls attention to the rapid progress being made in its introduction for building purposes. On the 85-story Empire State Building in New York City, to be the highest in the world, aluminum spandrels were specified, involving a large tonnage of light alloy. Recently the possibility of using aluminum or duralumin structurals in the upper stories of skyscrapers was discussed as a means of lightening the supported load throughout the structure.

◆

Hourly Rate or Piece Work?

Concrete paving contractors who use batch trucks often find it cheaper to hire them than own them. When hired, the more common practice is to pay the truck owners on a piece-work basis: so much a batch, so much a batch-mile, or so much a trip. This method causes much rivalry among the truck drivers. Often they race one another to the plant; sometimes they get out of line at the mixer in an effort to cut in ahead of competitors. Such actions make rivalry bitter, cause reckless driving and frequently affect job progress adversely.

Payment at an hourly rate seems less profitable to the contractor, by comparison, until one considers the advantages to be gained. It is possible to get good trucks and reputable truck owners to haul batches in most places today. These men and these machines are ready to do fast and honest hauling. By hiring at an hourly rate, the contractor obtains reliable service and the assurance of order and co-operation on the job.

The Mind as Well as the Eye

READING is like travel; we profit by it in proportion as we use our minds as well as our eyes. One man hurries through his reading or his journey, either as a matter of habit or else intent only upon reaching some destination or conclusion; another observes and reflects as he goes and fits what he sees or reads into his mental working equipment.

Because of this, travel for education is likely to be more fruitful than travel from habit or simply to cover the miles. So it is with reading. Reading from habit or simply for diversion or entertainment is less likely to awaken the mind to action than is the more purposeful reading undertaken to increase our working knowledge and strengthen our capacity for accomplishment.

Herein lies the advantage enjoyed by the business and industrial press over the lighter reading matter offered for popular pastime. It is an advantage to all concerned; to the editor who writes it and who must see that his product is timely and substantial, to the reader whose store of bread-and-butter knowledge is enriched and whose faculties are sharpened to meet the practical problems of his calling and to the advertiser whose story is sure to meet the minds as well as the eyes of men who have been primed by the reading pages to think of methods, machines and materials that can meet their daily needs.

Construction Methods has had frequent and conclusive evidence of all this. Its readers are methods-minded men who read its stories and study its pictures closely and who often derive from them information even beyond the expectation of the editors who prepare them. And, as a natural consequence, they are just as keenly interested in the helpful message that may be offered to them by the manufacturer through the advertising pages.

Willard Chevalier
Publishing Director

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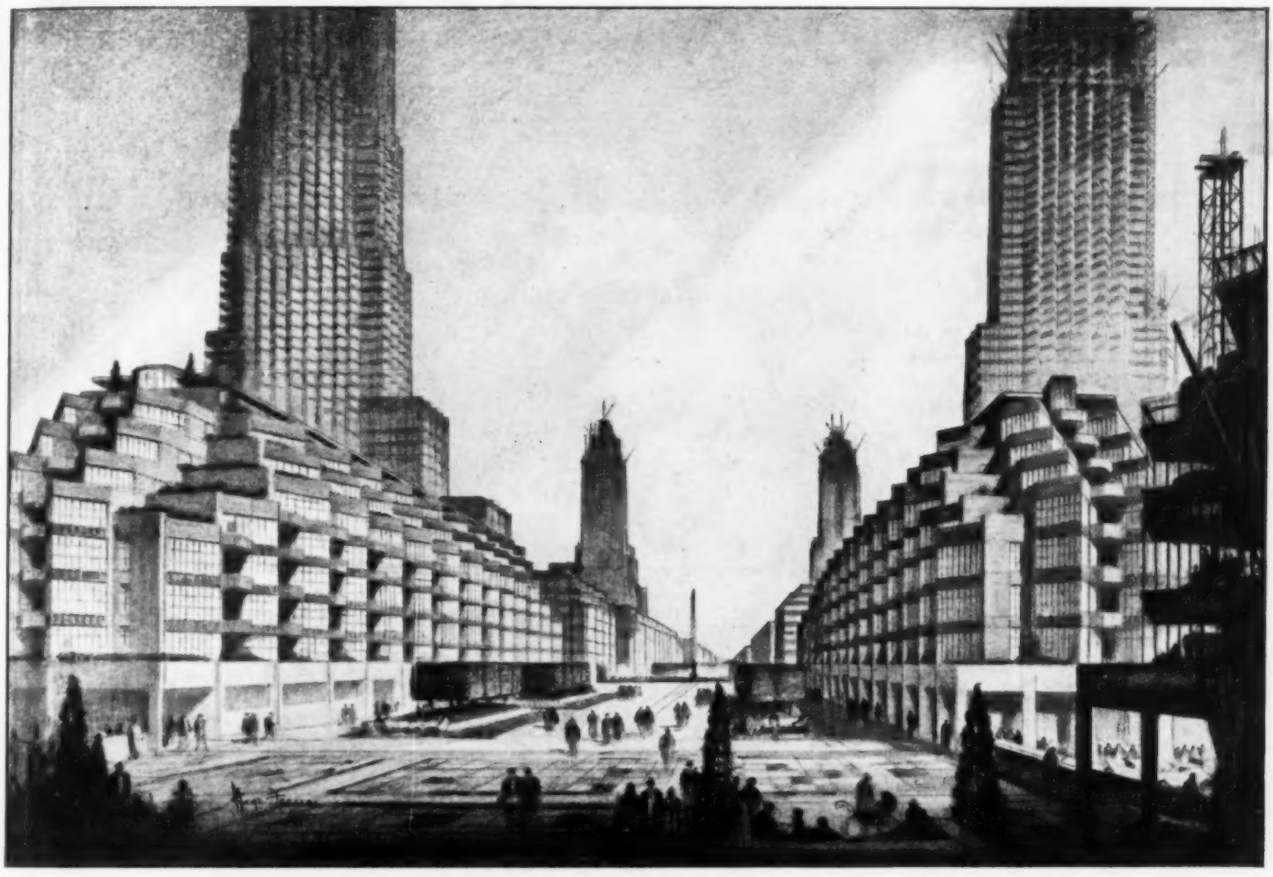
STRUCTURAL STEEL CREATED THE SKYSCRAPER

STEEL GIVES DAYLIGHT A CHANCE



"APARTMENT HOUSES OF THE FUTURE." IN THIS IMAGINATIVE DESIGN BY HUGH FERRISS A PROMENADE BRIDGES VEHICULAR TRAFFIC. AN ENLARGEMENT, ON SPECIAL STOCK FOR FRAMING, WILL BE MAILED WITHOUT CHARGE TO ANY ARCHITECT, ENGINEER OR BUSINESS EXECUTIVE.

MIGHTY, modern, adaptable steel . . . it stands alone, needs no bolstering—and when unconcealed by weaker materials brings light and air and majesty to cubist mass, to lance-like tower.

Windows, which in the fledgling skyscrapers were mere slits through heavy masonry, have grown in size and number. Tomorrow, curtain walls will yield to solid-section steel windows, to sheets of glass through which even ultra-violet rays may pass.

In small as well as large structures, steel is an ally of daylight, of speed, permanence and economy. It permits the most practical design for homes, schools, apartment or mercantile houses, industrial plants and small bridges. Steel has less bulk, greater strength than any other fire-resistive material. It secures more floor space; saves building time and labor; facilitates alterations, additions, removal.

Before building anything, find out what steel can do for you. The Institute serves as a clearing house for technical and economic information on structural steel, and offers full and free co-operation in the use of such data to architects, engineers and all others interested.

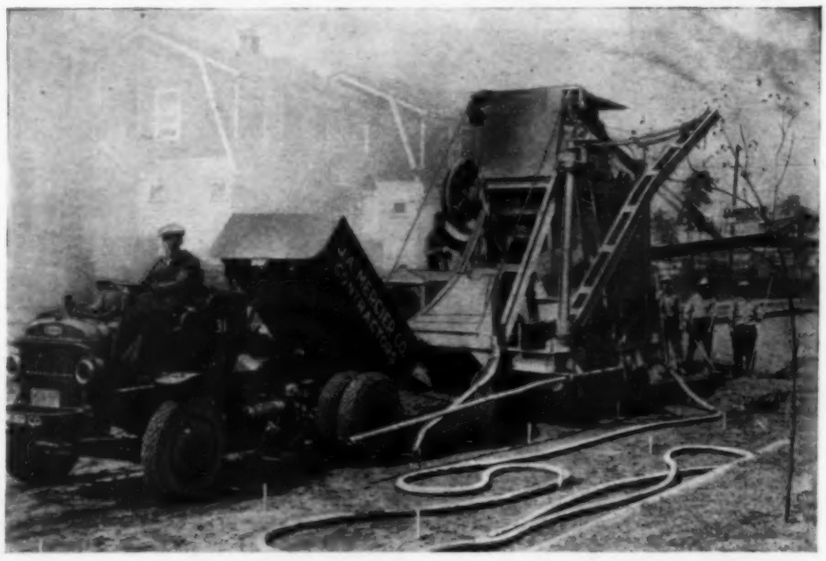
The co-operative non-profit service organization of the structural steel industry of North America. Through its extensive test and research program, the Institute aims to establish the full facts regarding steel in relation to every type of construction. The Institute's many publications, covering every phase of steel construction, are available on request. Please address all inquiries to 200 Madison Avenue, New York City. Canadian address: 710 Bank of Hamilton Bldg., Toronto, Ontario. District offices in New York, Worcester, Philadelphia, Birmingham, Cleveland, Chicago, Milwaukee, St. Louis, Topeka, Dallas, San Francisco and Toronto.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

STEEL INSURES STRENGTH AND SECURITY

Mercier finds Autocar the Truck of Trucks for single-batch gravity dump work

There are ten Autocars in the fleet of J. A. Mercier Company, paving and general contractors of Detroit. Four of them are tractor models with 99-inch wheelbase, mounted with single-batch gravity dump bodies. They are ideally suited to paving work on soft grades where turning room is at a minimum.



THEY knew what they wanted,—these engineers of the J. A. Mercier Company, prominent paving, sewer and water contractors of Detroit. Long wheelbases, trucks with heavily-laden multiple-batch bodies are not practical for a large part of their contract work. Grade conditions in Detroit are very soft, and even sandy. Operation over rough ground and rapid, abusive dump action demand chasses that are rugged and durable. Autocar performance is well known to Mercier, whose fleet has included Autocars with multiple-batch bodies for years. When an alert Autocar representative suggested the 99" wheelbase tractor chassis with single-batch dump body, the idea was welcomed. Four were ordered. They are proving eminently satisfactory because of their ruggedness and short-wheelbase handiness in work where carefully selected units of other makes had fallen down. Mercier engineers knew what they wanted. Their vision extended beyond the first cost. There are construction jobs in every community, that need sturdy, precision-built, short-wheelbase Autocars.

PRECISION BUILT

AUTOCAR TRUCKS

THE AUTOCAR COMPANY, ARDMORE, PA.

It digs without any division or loss of engine power between crowd and hoist!

It crowds out beyond the boom without the crowd cable pulling against the hoist cable.

It travels with positive traction while turning—a big time saver in the hole.

Steering is from the operator's seat regardless of the position of the cab—a time saver in close quarters!

The "feather-touch" control brings a new ease in spotting the dipper.

Ball bearings on all high speed shafts save the power that babbitt and bronze bearings waste.

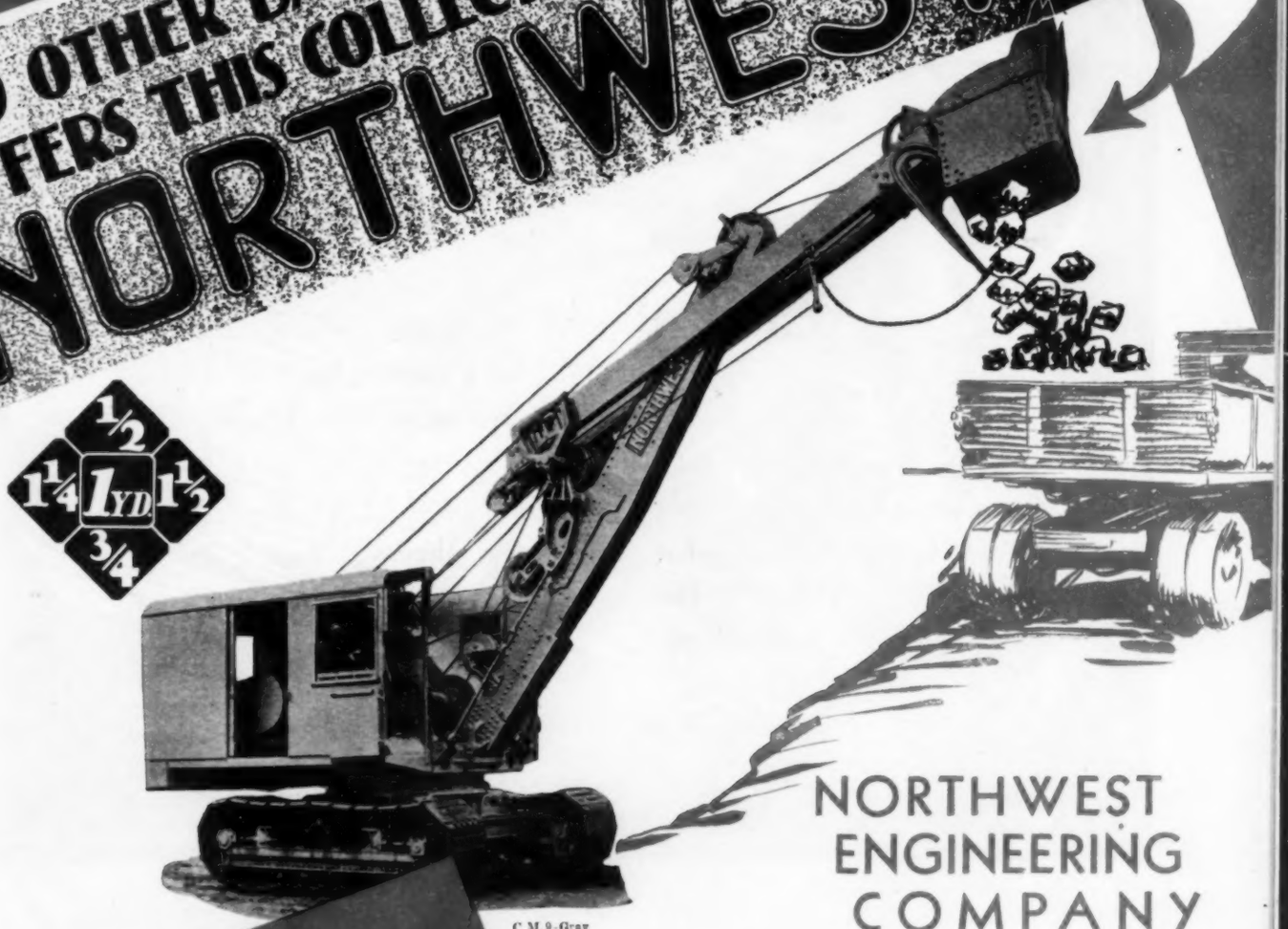
The helical gear drive running in oil gives years of service without the need for constant adjustment and replacement required with chains.

NO OTHER BASEMENT SHOVEL OFFERS THIS COLLECTION OF FEATURES

NORTHWEST

North-west

REACH OUT BEYOND THE BOOM



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NORTHWEST ENGINEERING COMPANY

The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

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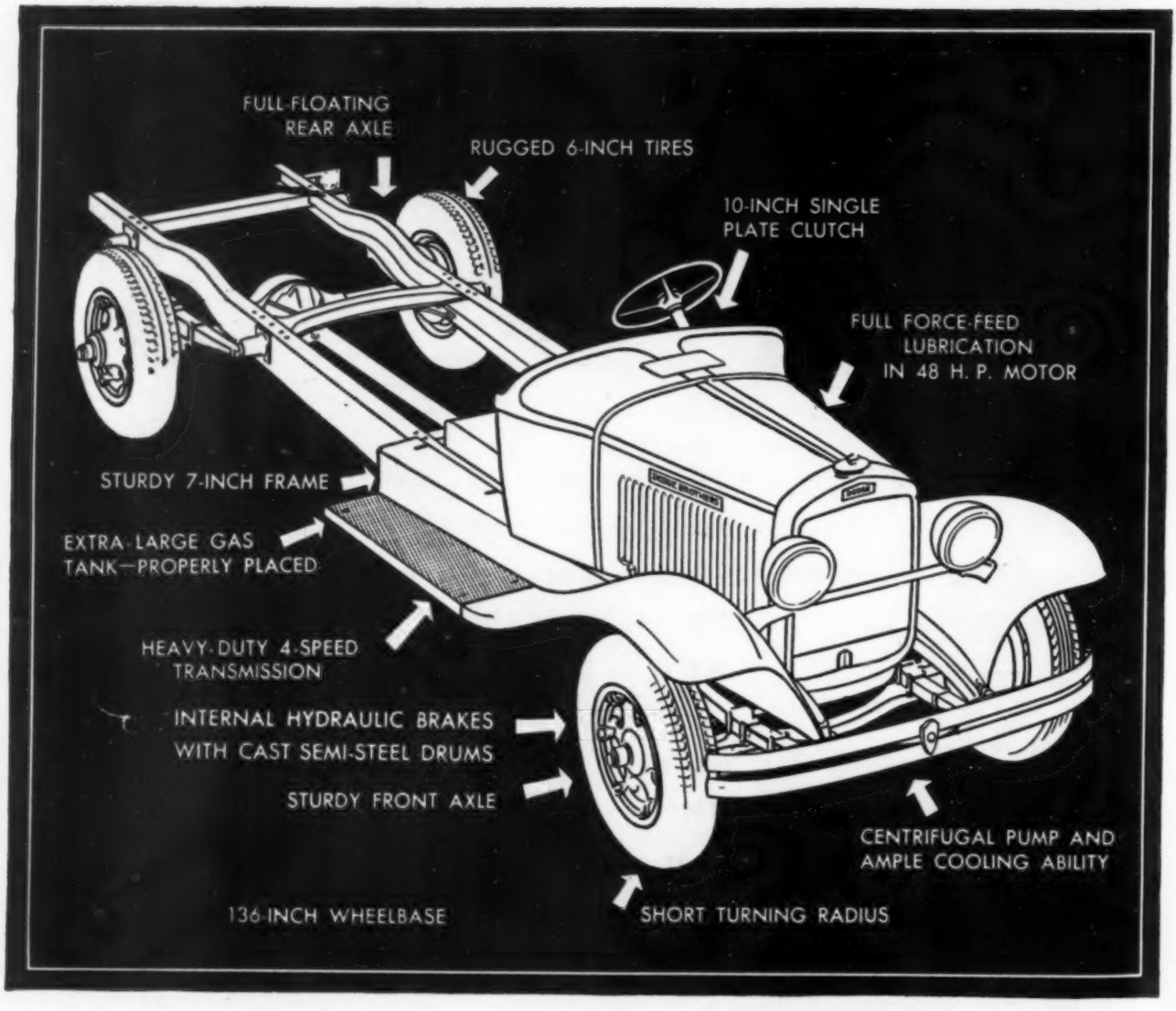
1½ TON DODGE


FULL-FLOATING REAR AXLE
RUGGED 6-INCH TIRES
10-INCH SINGLE PLATE CLUTCH
FULL FORCE-FEED LUBRICATION IN 48 H. P. MOTOR
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EXTRA-LARGE GAS TANK—PROPERLY PLACED
HEAVY-DUTY 4-SPEED TRANSMISSION
INTERNAL HYDRAULIC BRAKES WITH CAST SEMI-STEEL DRUMS
STURDY FRONT AXLE
CENTRIFUGAL PUMP AND AMPLE COOLING ABILITY
136-INCH WHEELBASE
SHORT TURNING RADIUS

TRUCK

$595

F. O. B. DETROIT . . DUAL REAR WHEELS AT SLIGHT EXTRA COST

A NEW QUALITY TRUCK WITH FULL-FLOATING REAR AXLE . . 48-HORSEPOWER MOTOR . . INTERNAL HYDRAULIC BRAKES . . 4-SPEED TRANSMISSION . . 136-INCH WHEELBASE . . 10-INCH SINGLE PLATE CLUTCH . . FULL FORCE-FEED LUBRICATION . . 7-INCH FRAME . . AND MANY OTHER NOTABLE FEATURES

SEE YOUR DODGE BROTHERS DEALER . . SEE THIS NEW TRUCK . . DRIVE IT

COMPARE IT PART BY PART WITH ANY TRUCK YOU LIKE . . IT IS TYPICALLY DODGE IN PERFORMANCE, DEPENDABILITY, ECONOMY AND EARNING ABILITY

THE COMPLETE LINE OF DODGE TRUCKS RANGES IN CAPACITIES FROM 1000 POUNDS TO 11,800 POUNDS

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NEVER BEFORE—

. . . . . Such speed, simplicity and ruggedness in a 1/2-yard shovel

The 1020 Bucyrus-Erie gives you an entirely new conception of a ½-yard shovel. Ruggedly built from start to finish — a high-grade machine in every way — it wins immediate respect and confidence.

Note, at the left, some points of construction. Such features leave no doubt about the reliability of this machine. And when you get reliability with the perfectly balanced power and speed of the 1020, you have a small shovel without an equal. Users everywhere are amazed at its performance!

Built by the world's largest manufacturers of small shovels — the 1020 is an achievement of commanding importance. Behind it is actual field experience with nearly 11,000 machines.

1020

SEE THE 1020 IN OPERATION

We'll tell you where you can see it. Examine it carefully, point by point. Watch it dig with its remarkable speed. Then you'll say, as 1020 users declare — it's the greatest ½-yard shovel ever built!

Write today for the 1020 Bulletin — get all the facts at once!

Representatives throughout the U. S. A. Offices or distributors in all principal countries. Branch Offices: Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Dallas, San Francisco.

POINTS FOR COMPARISON

Check these features of the 1020 against any other ½-yard shovel: Large oversize shafts, bearings and clutches. Unit steel construction. Rugged box-girder boom. Frictionless bearings. Gears incased and running in oil. Gas, electric, Diesel power. Quick convertibility to shovel, crane or dragline. The 1020 Bulletin gives complete description

A-89-9-30 CM

BUCYRUS-ERIE COMPANY, manufacturers of the only complete line — all sizes, types and powers. *Plants:* South Milwaukee, Wis., Erie, Pa., Evansville, Ind. *General Offices:* South Milwaukee, Wisconsin.

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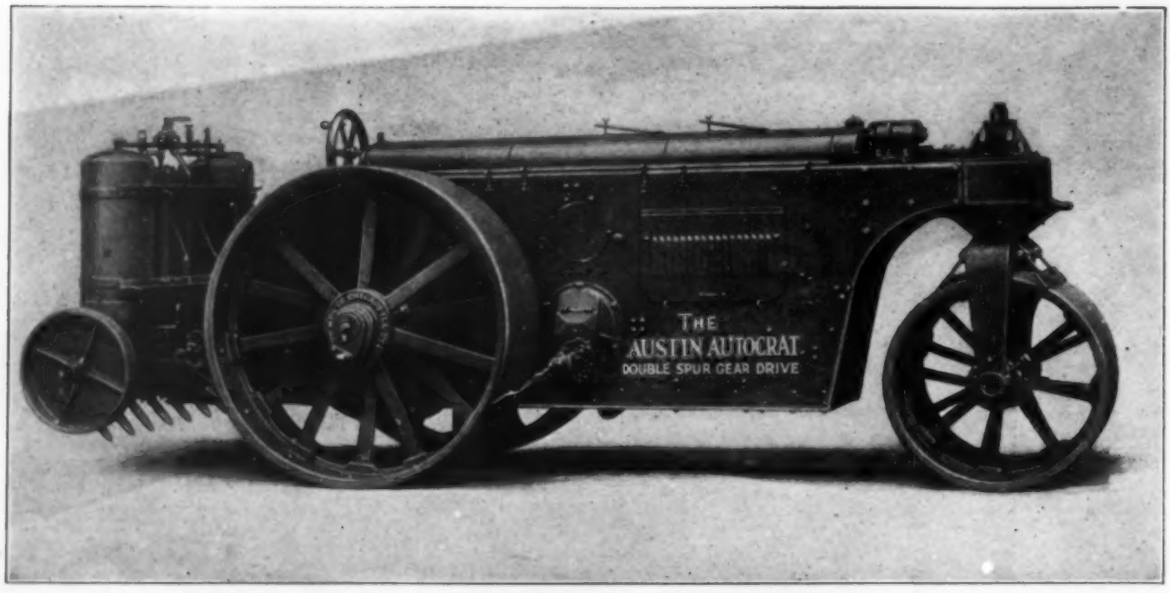


The Double Spur Gear Drive Autocrat equipped with powerful pneumatic scarifier.

Now! the *New* Austin Autocrat

DOUBLE SPUR GEAR DRIVE ROLLER

Outstanding Features of NEW AUSTIN AUTOCRAT

1. A double spur gear drive of exceptional efficiency
2. An abundance of power, not only for rolling, but also for the hardest jobs of scarifying
3. An unusually short wheel base, adding greatly to the roller's maneuverability in close quarters
4. Ease of steering and handling; a revelation to those who have had experience with other rollers
5. Exceptionally low center of gravity, insuring smooth work and eliminating side sway and providing maximum safety.

The many improvements and refinements of the Austin Double Spur Gear Drive Autocrat Roller have established the Autocrat name more firmly than ever at the head of the list of fine performing rollers.

The highest type of workmanship and the most expensive materials and processes of construction make the New Autocrat definitely the last word in smooth, efficient roller performance. Such points as a rigid, stream-line frame, ½ inch Open Hearth steel side plates, unequalled ease of access to all working parts, and an improved front roll unit that provides the easiest steering of any roller on the market, are all evidence of the sincerity back of the effort to make the New Austin Autocrat the best and most economical roller purchase, for contractors and public officials, alike.

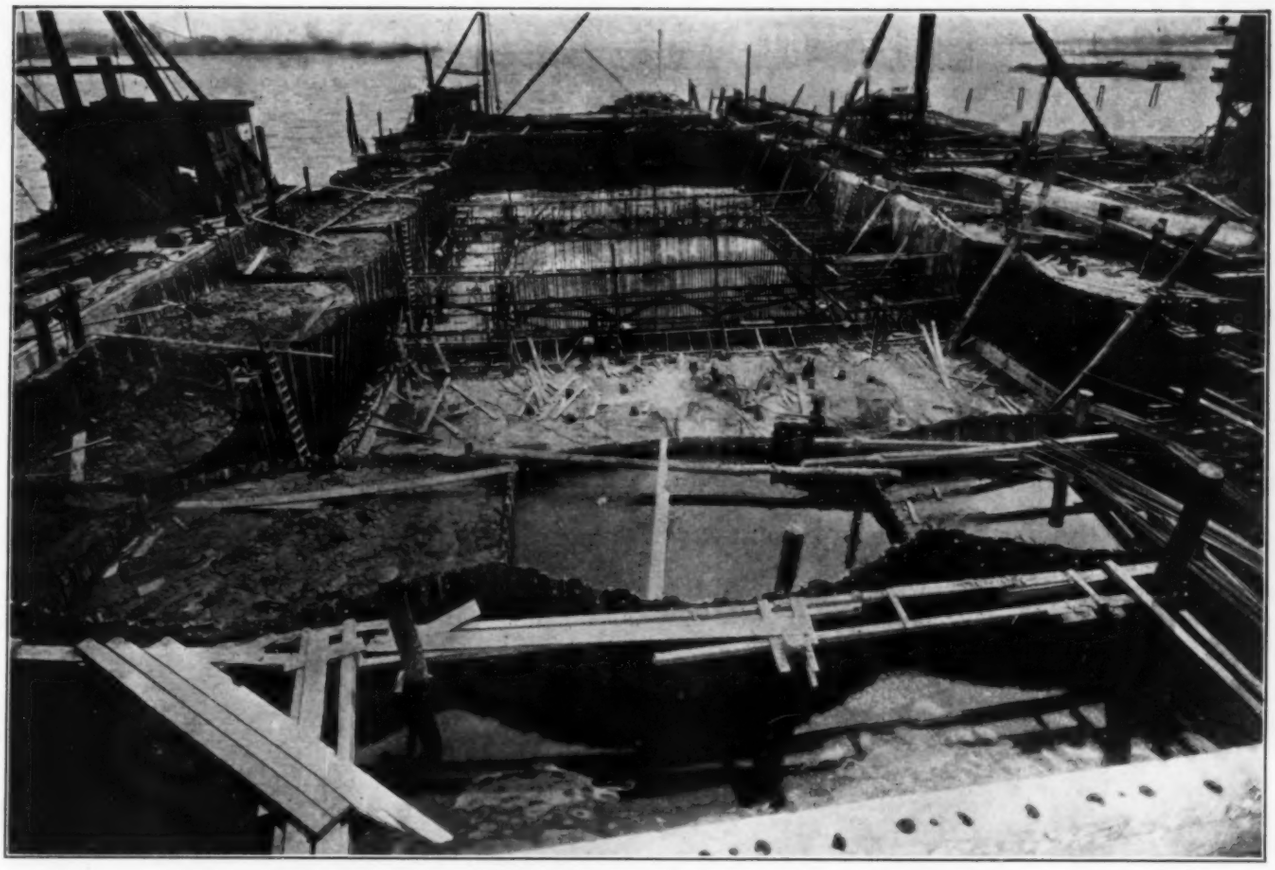
A heavy-duty, 4-cylinder engine directly connected to a heavy-duty sliding gear transmission provides an abundance of power for every rolling and scarifying task.

The transmission system provides two speeds forward and reverse. All gears, including the differential, are fully enclosed and run in oil. Alloy or heat treated steels are used throughout. Bearings, gears and shafts have a much greater factor of safety than is usually found on road rollers.

The double-disc type of clutch is used. By using two, one for forward and the other for reverse, it is possible to shift from forward to reverse without changing gears or releasing a master clutch.

Send for interesting, descriptive booklet and complete information. The Austin-Western Road Machinery Co., 400 N. Michigan Avenue, Chicago, Ill. Branches in principal cities.

Austin-Western
ROAD MACHINERY



LACKAWANNA
ARCHED-WEB PILING
in cellular cofferdam for Sewage Disposal Plant, New Haven, Conn.

Lackawanna Arched-Web Piling Section AP 14 was used in constructing this cellular cofferdam, the inside dimensions of which were 208 ft. by 96 ft. The distance between the inside and outside walls was 13 ft., 8 in.; the spacing of the diaphragm walls averaged about 25 ft.

Lackawanna Steel Sheet Piling was used in 35-ft. lengths for the outside and inside walls, and in 32-ft. lengths for the diaphragms. The top of the walls and diaphragms was about 1 ft. below high water. The cofferdam was excavated to a depth of 25 ft. below high water. A concrete seal 7 ft. thick was poured before unwatering.

To speed up assembling and driving and to eliminate excessive false work and templates, the outside and inside walls were driven in straight lines. When the fill was placed in the pockets, these walls were permitted to bulge as shown by the illustration. Ordinarily straight-web piling would have been used, for the reason that the piles are in tension in this type of cofferdam. The contractor preferred Lackawanna 14-inch arched-web section, however, and used it, since this section was known to have ample strength to resist the tendency of the arches to spread. The steel-sheet piling was driven without difficulty, and the cofferdam proved extremely watertight. The results obtained were entirely satisfactory to the contractor.

■

C. W. Blakeslee & Sons, New Haven, Conn., *Contractors.*

Fuller & McClintock, New York City, *Engineers.*

BETHLEHEM STEEL COMPANY, General Offices, Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Cincinnati, Detroit, Chicago, St. Louis

Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Los Angeles, Portland, Seattle, Honolulu

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BETHLEHEM

Where traction *means* yardage

THE scraper fills quickly in soft soil—there is need for the full power of the dependable engine in the "Caterpillar" Tractor. The long, wide tracks of the "Caterpillar" ripple over the surface of the soft soil with no wasteful slip. Tractor and scraper go into the corners, climb the steep grades, ride the soft places—handling yardage for the earth-mover and contractor with a saving of men, money and minutes.

• • •

Prices—f. o. b. Peoria, Illinois

TEN	$1100	TWENTY	$1900
FIFTEEN	$1450	THIRTY	$2375
SIXTY	$4175		

Caterpillar Tractor Co.

PEORIA, ILLINOIS *and* SAN LEANDRO, CALIF., U. S. A.

Track-type Tractors ✓ Combines ✓ Road Machinery

(There's a "Caterpillar" Dealer Near You)

CATERPILLAR
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TRACTOR

"HERCULES"

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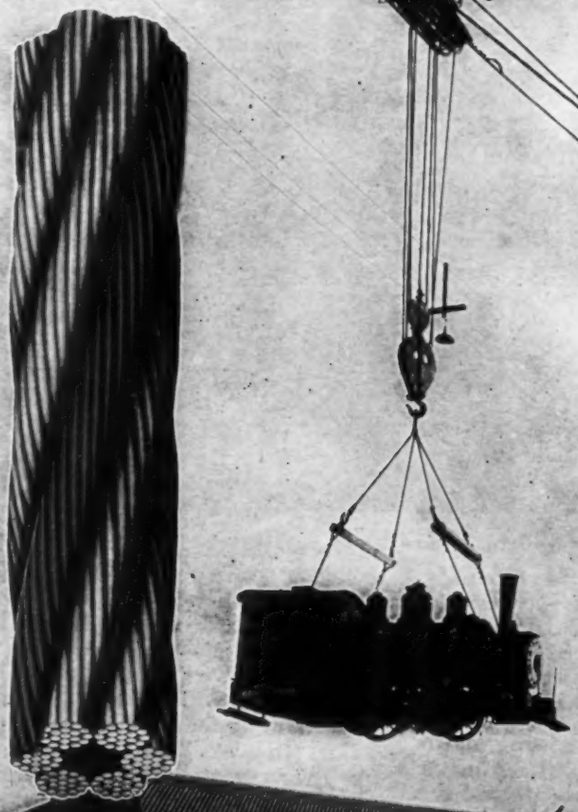
RED-STRAND WIRE ROPE



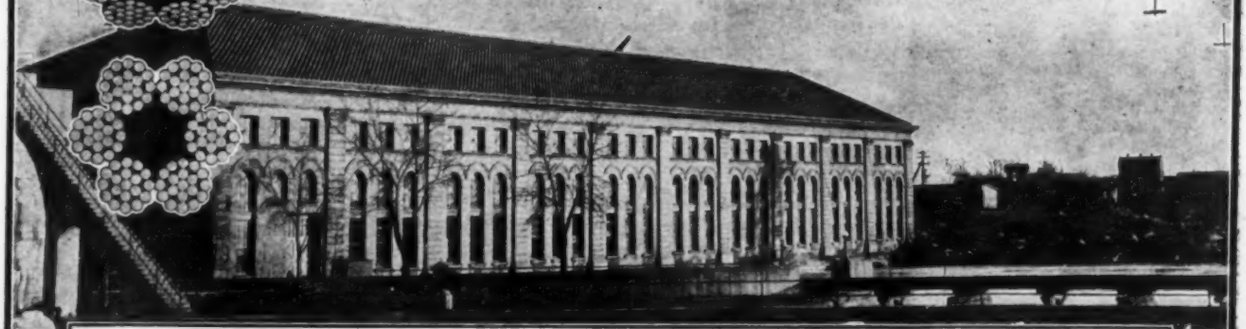
RESULTS are what count, and it is because of the service record of this wire rope that we feel justified in asking you to give it consideration.

While "HERCULES" (Red-Strand) Wire Rope is extra strong, it is also extremely tough and wear-resisting, and it is the correct combination of all of these vital qualities that accounts for its long life on present-day material handling equipment.

A heavy toll is taken every time a wire rope replacement is necessary. If you want to minimize this toll, give "HERCULES" a chance to prove its remarkable ability. Try it on your hardest work, for there is where its superiority is the most outstanding.

"HERCULES" (Red-Strand) Wire Rope is made in both Round Strand and Patent Flattened Strand constructions. These constructions are illustrated in our No. 37 Catalog, a copy of which we shall be glad to send to anyone interested.

A. LESCHEN & SONS ROPE CO.
ST. LOUIS



Made Only by **A. Leschen & Sons Rope Co.** Established 1857
5909 Kennerly Avenue
ST. LOUIS
New York Chicago Denver San Francisco

POWER THAT NEVER LAGS

WORK moves swiftly — surely — when Cletrac power and traction are on the job. Blades bite deeper — stubborn earth and rock yield quicker — heavy loads move faster—time and labor are saved.

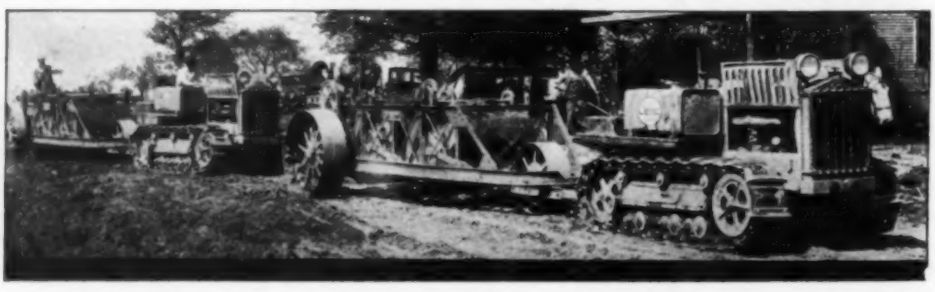
Whether it's on a road doing maintenance work, down in the mud of a drainage ditch, levelling ground for an airport, building a dam, or handling any one of countless outdoor jobs, Cletracs perform with an energy and speed that clip costs on contracts and make appropriations go farther.

Cletracs have power to spare for heavy loads and hard pulls. Their broad steel tracks grip surely and firmly in bad footing and on steep grades. They control easily. They are economical. They have the stamina and strength to stand up under the most gruelling service. In every detail they measure up to the very highest tractor standards.

There is a Cletrac of correct size for every power job in highway, contract and industrial work. See the Cletrac distributor nearest you for a demonstration — or write direct for complete information.

THE CLEVELAND TRACTOR CO., 19323 Euclid Avenue, Cleveland, Ohio

Cletrac
Crawler Tractors



USED ON THE PIERS OF NEW HUDSON RIVER BRIDGE AT 176TH ST., NEW YORK CITY.

IN USE ON NEW SUBWAY CONSTRUCTION IN NEW YORK CITY.

USED EVERYWHERE FOR PUMPS.

Wherever Nuts Are Turned Time and Money Can Be Saved

By Using

THE

FAVORITE Reversible Ratchet WRENCH

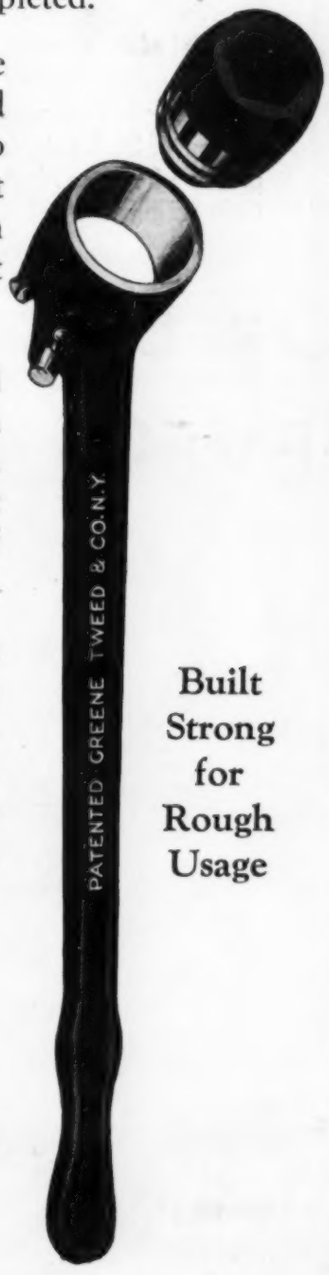
It works with the quick, straight ahead ratchet movement, and wrench head does not leave the nut until operation is completed.

Compare this with the time wasted by the old fashioned open end wrench that has to be removed from the nut at every part turn for a fresh hold—unnecessary lost motion.

Has the socket form of head that encompasses the nut on all sides with equal pressure. This tends to prevent wrench from slipping off nut.

Leading Contractors use the "FAVORITE" Wrench for speeding up the nut-turning portion of the contract, especially where the saving of time is a very important consideration.

Write us for full particulars.



Built Strong for Rough Usage

Greene, Tweed & Co.

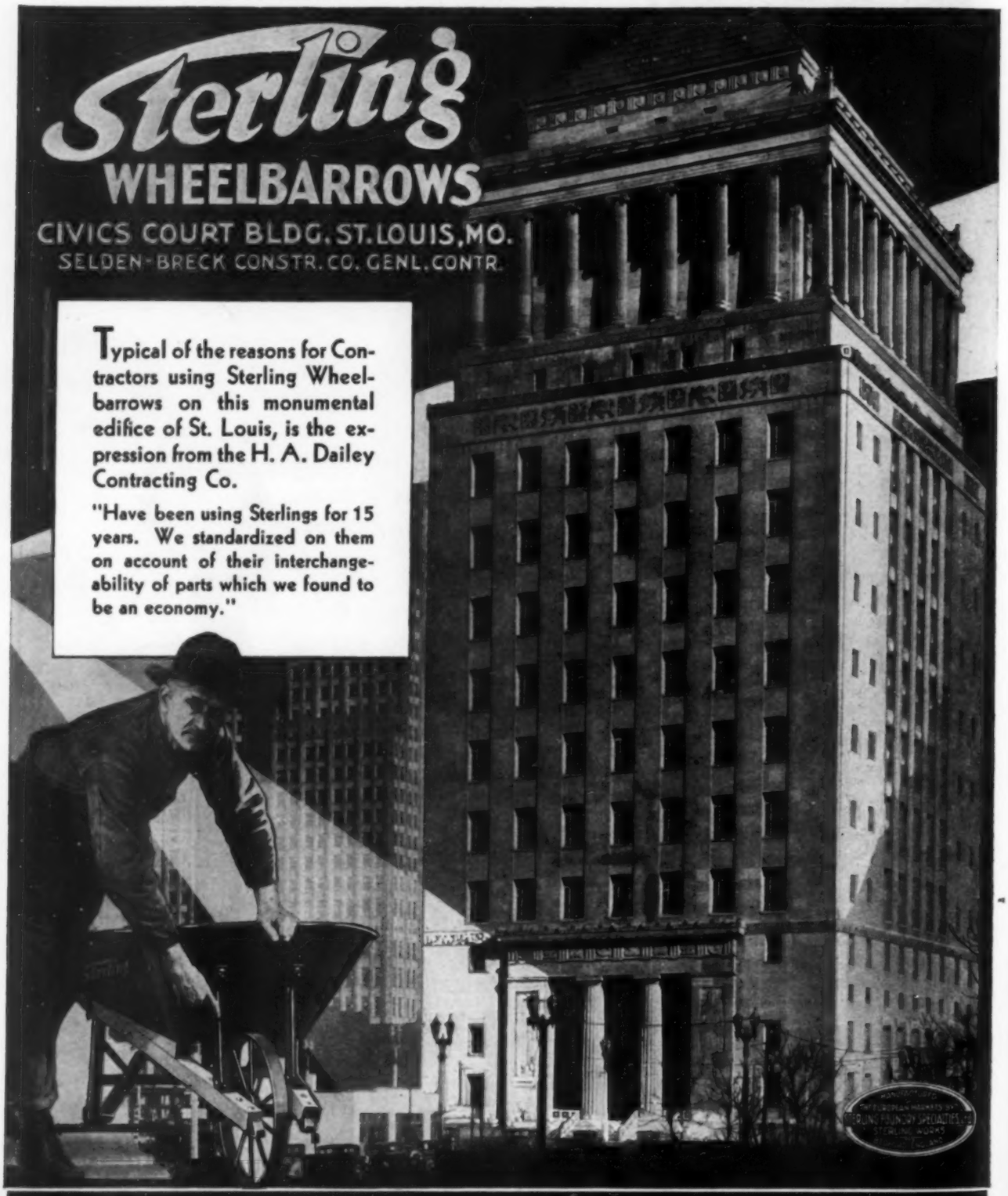
Sole Manufacturers

109 Duane St., New York

FROM GROUND-LINE . . . TO SKY-LINE

Sterling WHEELBARROWS

CIVICS COURT BLDG. ST. LOUIS, MO.
SELDEN-BRECK CONSTR. CO. GENL. CONTR.



Typical of the reasons for Contractors using Sterling Wheelbarrows on this monumental edifice of St. Louis, is the expression from the H. A. Dailey Contracting Co.

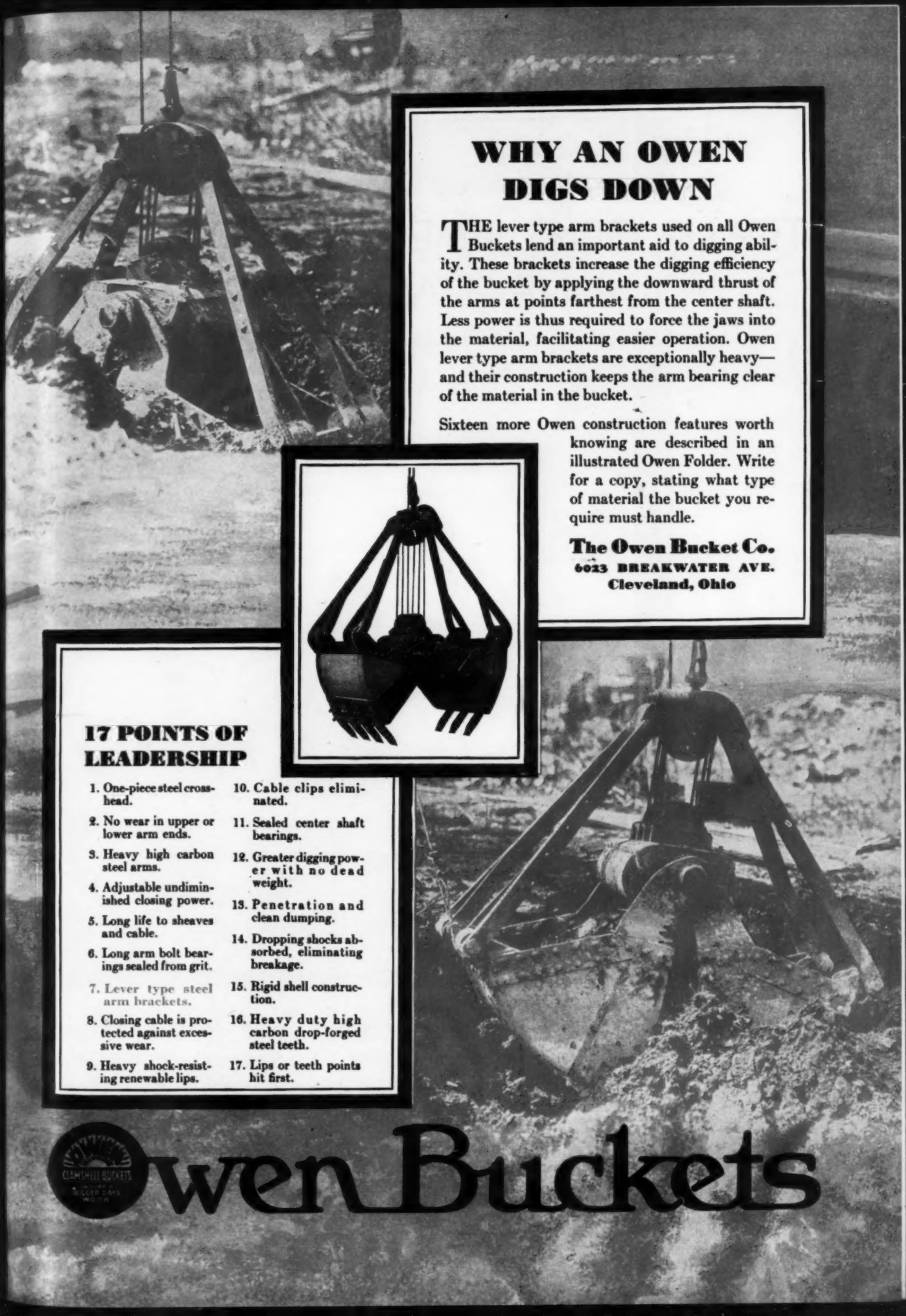
"Have been using Sterlings for 15 years. We standardized on them on account of their interchangeability of parts which we found to be an economy."

STERLING WHEELBARROW COMPANY

STERLING ON A WHEELBARROW MEANS MORE THAN STERLING ON SILVER

MILWAUKEE WISCONSIN

BRANCH WAREHOUSES—BOSTON, NEW YORK, PHILADELPHIA, PITTSBURGH, CLEVELAND, DETROIT, CHICAGO, ST. LOUIS



WHY AN OWEN DIGS DOWN

THE lever type arm brackets used on all Owen Buckets lend an important aid to digging ability. These brackets increase the digging efficiency of the bucket by applying the downward thrust of the arms at points farthest from the center shaft. Less power is thus required to force the jaws into the material, facilitating easier operation. Owen lever type arm brackets are exceptionally heavy—and their construction keeps the arm bearing clear of the material in the bucket.

Sixteen more Owen construction features worth knowing are described in an illustrated Owen Folder. Write for a copy, stating what type of material the bucket you require must handle.

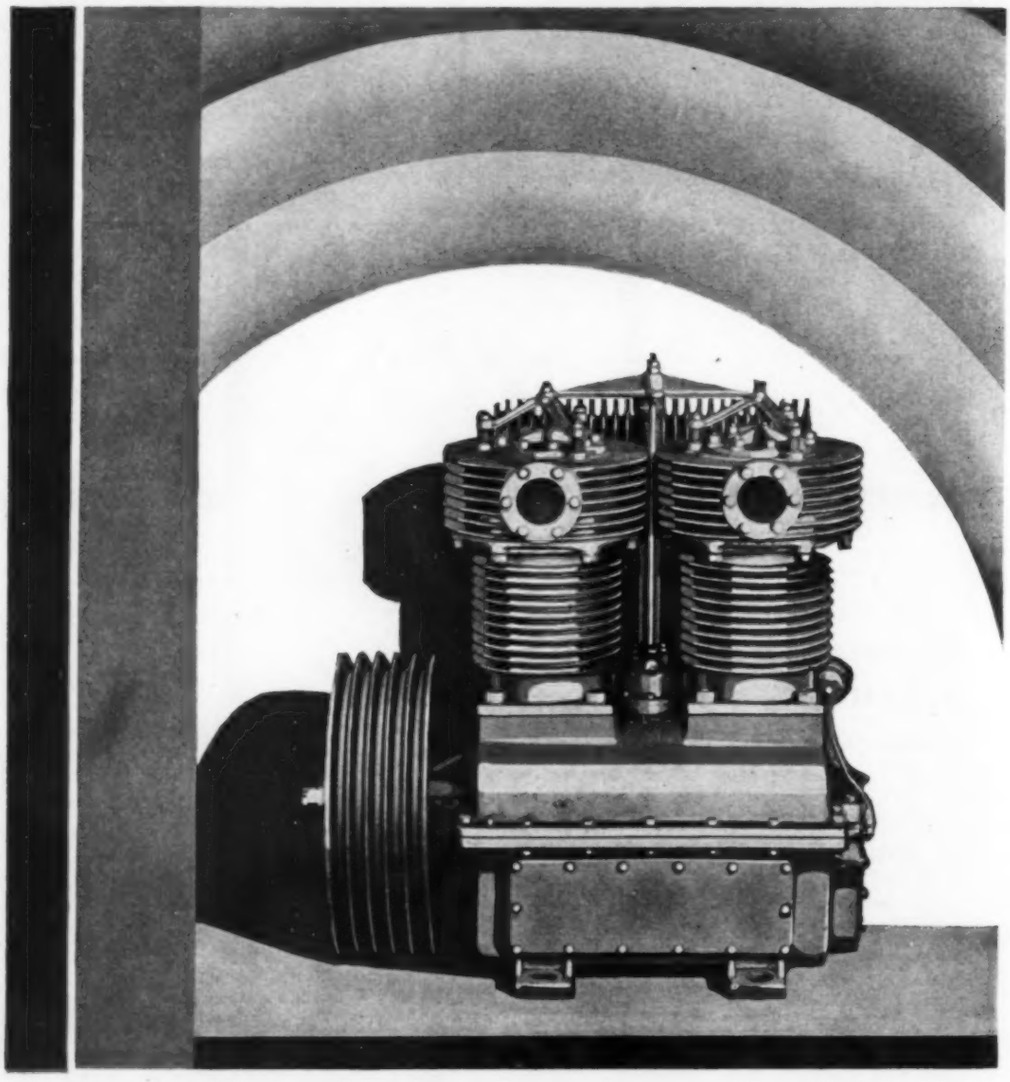
The Owen Bucket Co.
6023 BREAKWATER AVE.
Cleveland, Ohio

17 POINTS OF LEADERSHIP

1. One-piece steel crosshead.
2. No wear in upper or lower arm ends.
3. Heavy high carbon steel arms.
4. Adjustable undiminished closing power.
5. Long life to sheaves and cable.
6. Long arm bolt bearings sealed from grit.
7. Lever type steel arm brackets.
8. Closing cable is protected against excessive wear.
9. Heavy shock-resisting renewable lips.
10. Cable clips eliminated.
11. Sealed center shaft bearings.
12. Greater digging power with no dead weight.
13. Penetration and clean dumping.
14. Dropping shocks absorbed, eliminating breakage.
15. Rigid shell construction.
16. Heavy duty high carbon drop-forged steel teeth.
17. Lips or teeth points hit first.

Owen Buckets

STEP UP, GENTLEMEN, AND EXAMINE YOUR NEXT AIR COMPRESSOR



EXAMINE it *carefully:* for here is a great, successful idea in compressor manufacturing—here is a compressor that delivers *air-cooled air* . . . Examine it *with respect:* for while it is unique, it has been in the field for years, and it is thoroughly tested and proved . . . Examine it *critically,* with thought for your own jobs—for here is a machine that will fit in as though made to your order.

. . . *The Davey Compressor!*

For many years a commercial success. Davey Air Compressors have been hard at work for a number of years—doing a real job, each season through.

Air-cooled. Davey is the first to design and build a practical, commercially successful air-cooled compressor. Heads and manifold are of special aluminum alloy, with deep fins that greatly increase radiation. Heat generated under compression is conducted rapidly out into the air—not allowed to "pile up" in compressor heads.

No carbon formation. This quick disposal of heat keeps the compressor heads constantly cool and prevents burning of oil on valves. Davey Compressors work constantly at their full capacity because valves are always clean—no matter how long they may have run.

Compressed air right at the job. Davey Compressors are furnished ready for mounting on "Caterpillar" or McCormick-Deering tractors; on skids for trucks, railroad push cars, etc.; or on regular highway trailers. They travel wherever wheels or "cats" can go.

Capacity. 142 cubic feet per minute at full operating pressure—more than sufficient to operate two cement breakers; two rotating jack hammers in ordinary service; four tie tampers; or other tools of similar heavy requirements.

Valuable Booklet Free. Detailed information, operating data, and other valuable facts are given in a booklet we have just prepared. Your inquiry is cordially invited.

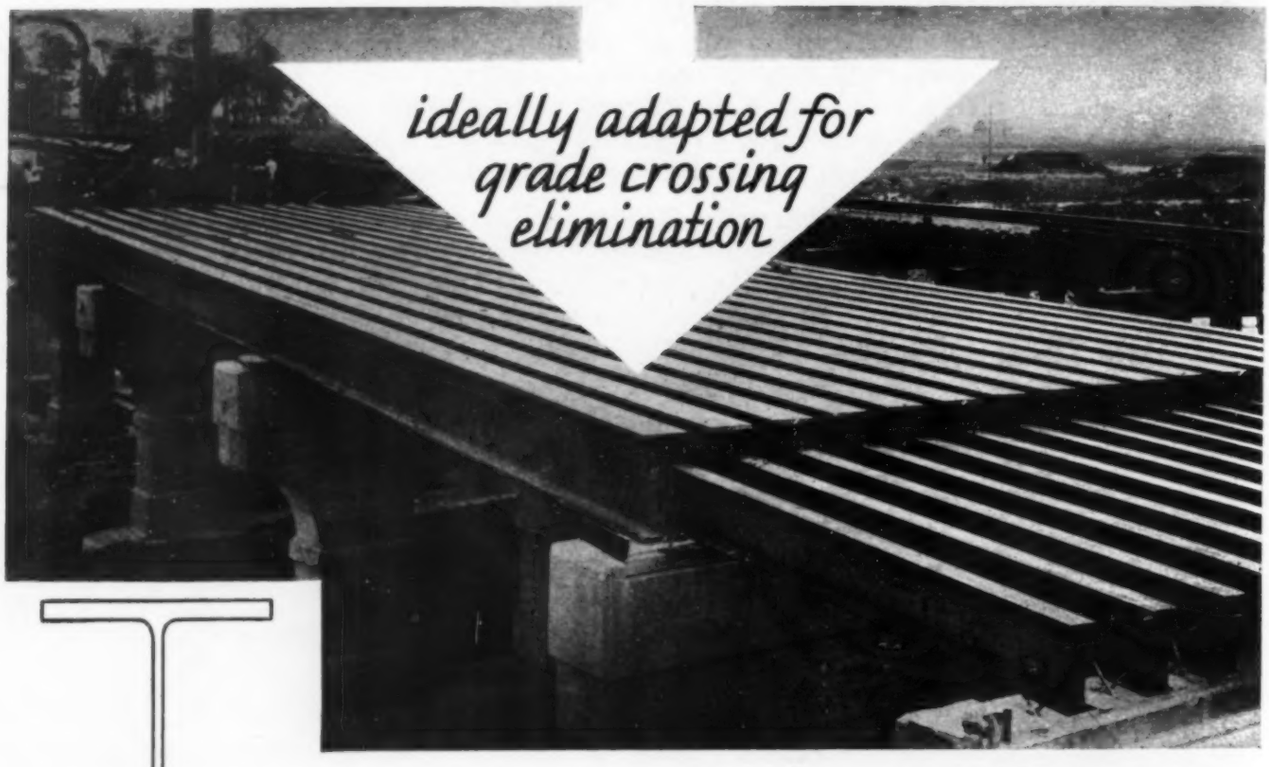
DAVEY COMPRESSOR COMPANY, INC.
KENT, OHIO
SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

←Standard mounting of Davey Compressor on "Caterpillar" Tractor . . . Power take-off from tractor motor. Scientifically located to preserve operating balance of tractor without interfering with drawbar or other work.
Skid mounting for truck—quickly moved from place to place. Powered by Hercules Motor, Model OOC, 55 H.P.; two sets of Multiple V-type belts, overcoming reverse torque of Compressor.

DAVEY Compressors

AIR COOLED AIR

CARNEGIE BEAMS



Pictured here is the recently completed grade separation of the Southfield Road in Detroit and the Detroit & Ironton Railroad. 30" Carnegie Beams formed the floor system of the span over the roadway and 18" Carnegie Beams over the two sidewalks.

A SIMPLE and economical solution of the problems of highway and maintenance of way engineers engaged in grade separation work is offered by Carnegie Beams.

The series comprises a full range of beam, girder and column sections of high efficiency as measured by the ratio of section modulus to the weight. Heavy sections, up to 36″ deep and designed primarily for heavy loads on long spans, offer a wide selection of flange widths and section moduli as high as 1102.7 inches^3. They eliminate the fabrication necessary in built-up plate and angle girders.

Carnegie Beams are characterized by flanges of uniform thickness without taper. The elimination of internal flange slope provides for simple connections and ease of fabrication and erection.

Our engineers are ready to help you on any problems involving your steel requirements

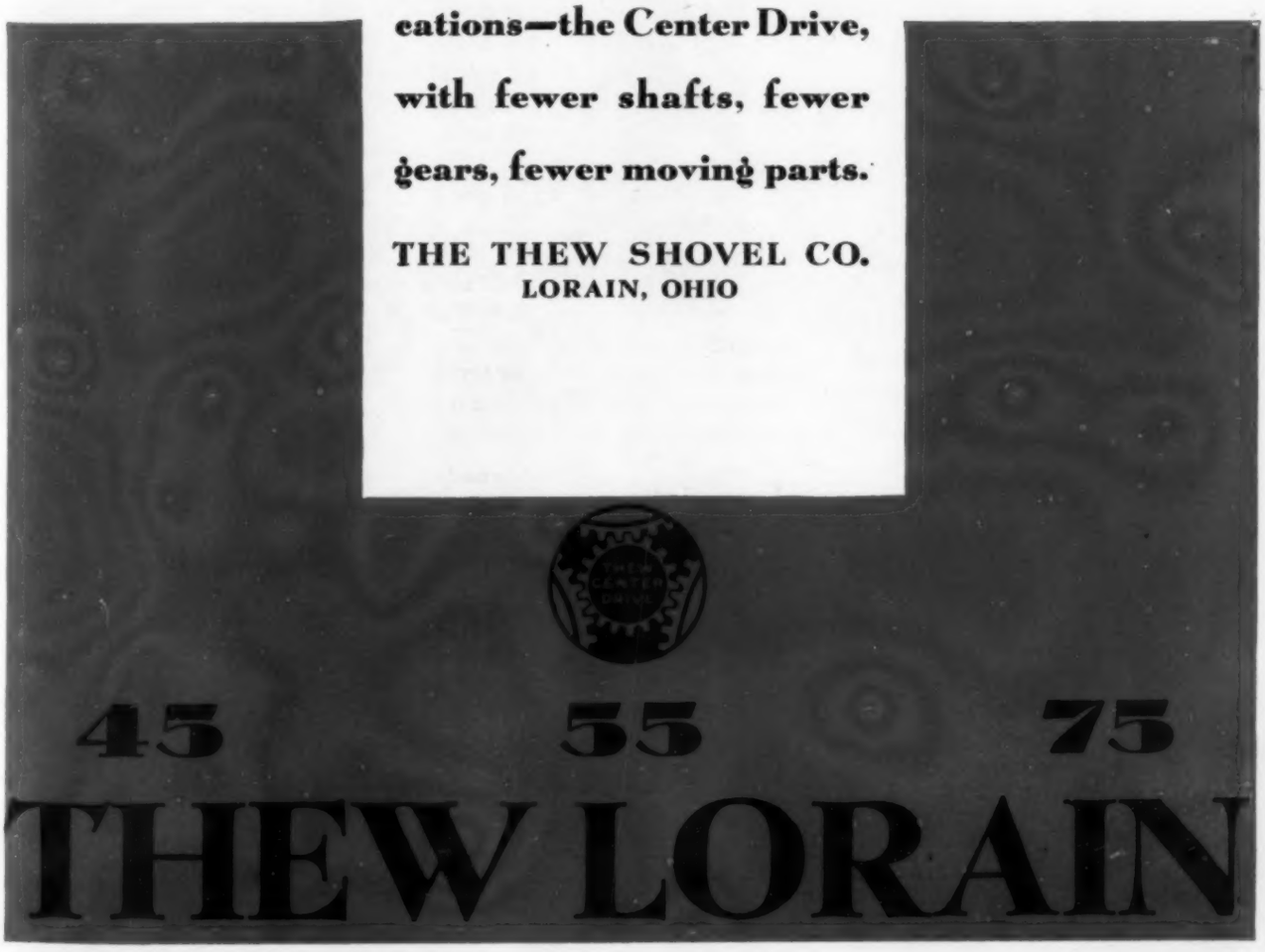
CARNEGIE STEEL COMPANY - PITTSBURGH, PA.

Subsidiary of United States Steel Corporation

85

EVERY extra moving part in a machine eats up power, every extra gear means that much more chance for wear, replacement and resulting hold up in operation. * That is why Thew Lorain machines are built to the simplest of all shovel and crane specifications—the Center Drive, with fewer shafts, fewer gears, fewer moving parts.

THE THEW SHOVEL CO.
LORAIN, OHIO



Roebling

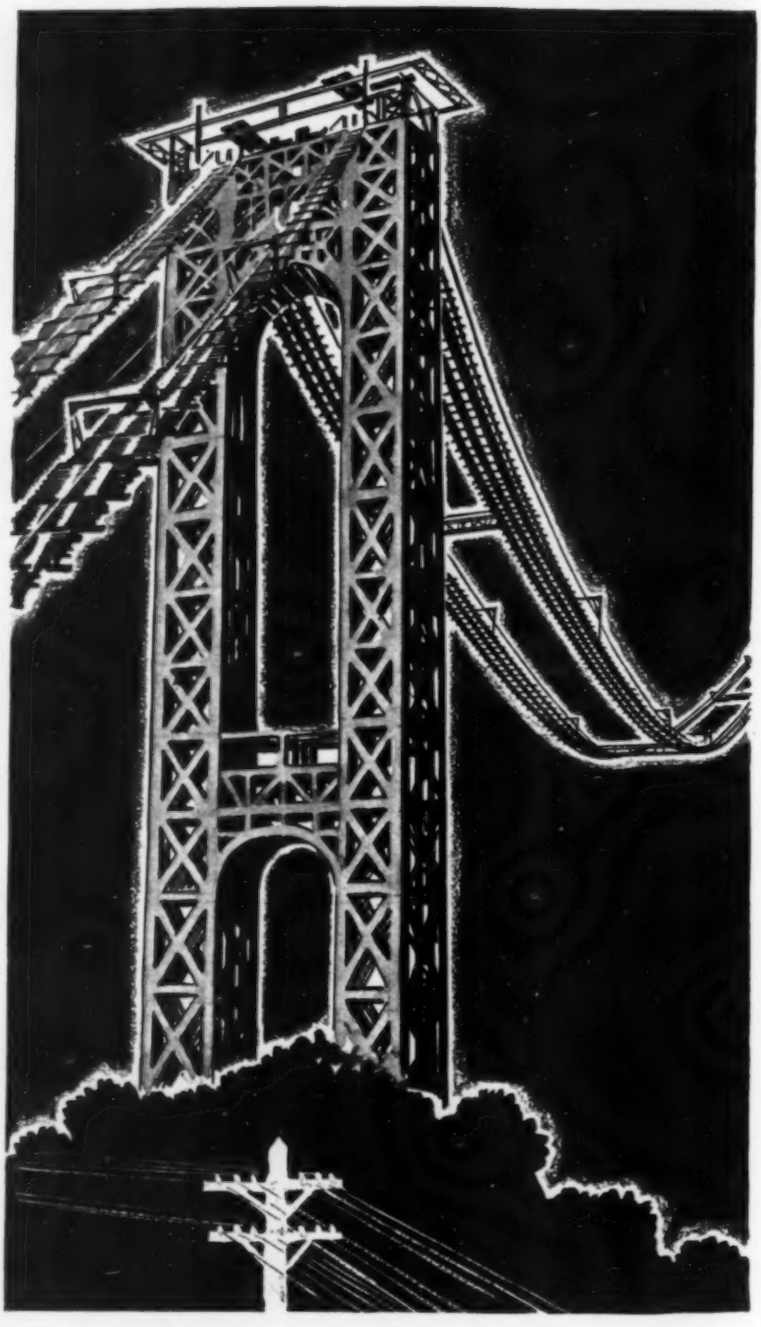
NEARING COMPLETION!

One year ago, the first foot bridge cables were lifted into position on the towers of the world's greatest suspension bridge, connecting New York and New Jersey across the Hudson River and *today*, the spinning of the four mammoth cables is almost completed.

The Roebling Company has been identified with most of the famous suspension bridges erected in this country during the past century. From the building of the first parallel wire suspension bridge over the Niagara River, to the mighty span now in construction across the Hudson, is a far cry.

Essentially, the same aerial spinning process invented by John A. Roebling in 1854, for the construction of the *10-inch diameter* cables on the Niagara suspension bridge, is employed on the monster *36-inch diameter* cables for the new Hudson River Bridge. Improved methods of spinning, however, have greatly reduced the time required for this task, and the work which occupied thirteen years for completion on the Brooklyn Bridge, will be accomplished on the mighty Hudson River Bridge in five years or less.

In the erection of this span, Roebling Products other than the wire for the cables will also play a prominent part. Over 500,000 feet of Wire Rope in sizes from ½" to 2⅞" diameter; 60,000 feet of Steel Wire Strand; 485,000 feet of Electrical Wires & Cables; 92,000 square feet of Wire Netting; hundreds of "Blue Center" Steel Wire Rope Slings; thousands of Wire Rope Fittings and many other products in lesser quantities have been used.



John A. Roebling's Sons Company
Trenton, New Jersey

One man can handle it!

Used successfully by:

Public Utilities
Railroads
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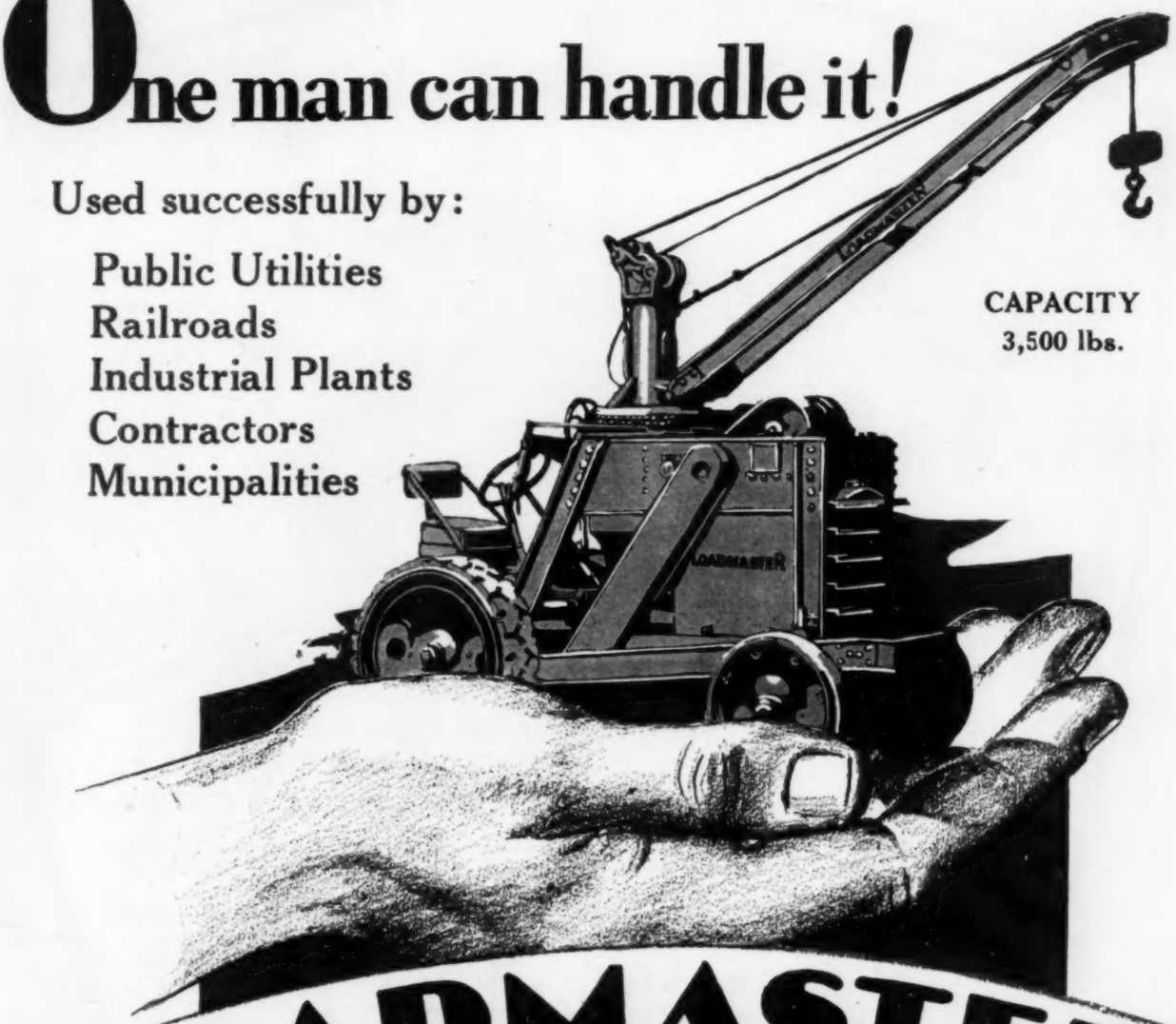
CAPACITY
3,500 lbs.



LOADMASTER
SWING ~ CRANE

Frederic H. Poor, Inc.
342 Madison Avenue
New York, N. Y.

Send for catalog.

Tramway carrying 220 tons hourly of sand and gravel for the construction of the Pardee Dam in California. Built for the contractors—Atkinson Construction Co.
Locked Coil Track ... cable used on American Steel & Wire Company Tramways.

AMERICAN
TRENTON-BLEICHERT SYSTEM
Aerial TRAMWAYS

This system provides an economical and dependable method of transporting material in every kind of country—over mountains, valleys, and rivers; to and from locations entirely inaccessible by surface routes.

We supply everything from the preliminary plan to the completed tramway. Let our engineers help you with your transportation problems.

AMERICAN STEEL & WIRE COMPANY

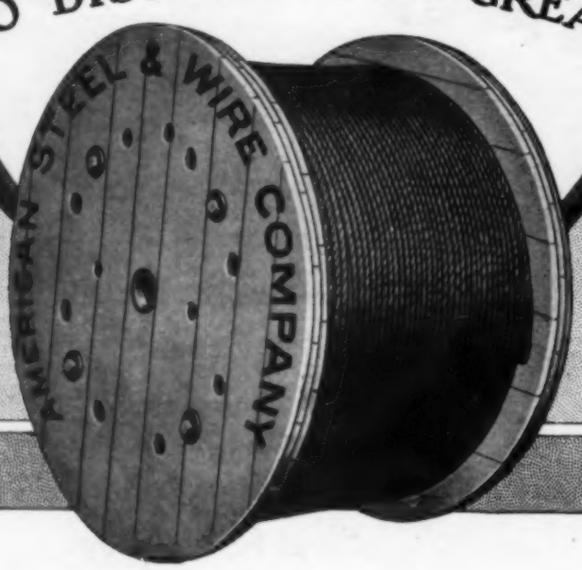
SUBSIDIARY UNITED STATES STEEL CORPORATION

208 S. La Salle St., CHICAGO — Offices in All Principal Cities — 30 Church St., NEW YORK

Columbia Steel Co. — San Francisco, Los Angeles, Portland, Seattle, Honolulu

Export Distributors: U. S. Steel Products Co., 30 Church St., New York

NO GRADE TOO STEEP
NO DISTANCE TOO GREAT



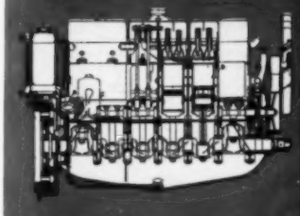
LARGEST MANUFACTURERS OF WIRE ROPE IN THE WORLD

Diesel-

3/4 TO 6 YARDS
COMMANDER
CONQUEROR
VICTOR
RAILROAD
GASOLINE STEAM
ELECTRIC
DIESEL

Osgood Diesel Conqueror in action, clearing a railroad right of way to a lumber camp in the North Pacific woods. This shovel is powered with a Buda-M. A. N. diesel engine.

Greater POWER · *Greater* ECONOMY *Greater* YARDAGE



One of the chief reasons for the success of the Diesel Engine is its responsiveness at extremely low speeds. When gasoline engines fail, which is usually at low speeds, the diesel continues to give sturdy, efficient power—even at 50% below normal.

The Osgood Diesel Engine equipment represents the latest development in light weight, high speed, full diesel engines for shovels. Here are combined extra power and exceptionally low fuel cost.

THERE is no "stalling" on the job with Osgood Diesels. In hard, tough digging—through rock, hard pan, gumbo, or course shale—it noses its way with the ease of a conqueror—a glutton for work with a slight appetite for low cost fuel.

No other form of power bites its way through, delivers more positive power when needed most, gives you greater yardage at such low wages as the Osgood Diesel.

The Osgood Diesel "hangs on" when all other internal combustion engines fail. At low speeds—even below 50% of normal, the Osgood Diesel increases its pulling power—more determined than ever to fight back—to give you a *more* profitable day's work.

THE OSGOOD CO.
MARION OHIO

G-E 125-hp. wound-rotor induction-motor drive for aerial tramway used on Pardee Dam project

G-E motorized aerial tramway constructed by the American Steel & Wire Company and used to transport sand and gravel to the site of the Pardee Dam, Valley Springs, Calif.

Motorizing the "Longest Link"

WHEN materials must be conveyed two, three, or more miles from supply base to site, then aërial tramways often become the longest link in the production chain that rushes great projects to completion.

The new $7,000,000 Pardee Dam was an excellent example. Here, 615,000 cubic yards of concrete aggregate were transported three and one-half miles by tramway often at the rate of 220 tons an hour, 24 hours a day. Over 1,400,000 tons of aggregate rode the cables. G-E motors helped make this engineering feat possible, and there was never a delay due to either the electric drive or the tramway.

Whether above the ground or below, in great projects or small, there you will find G-E motors and control faithfully serving.

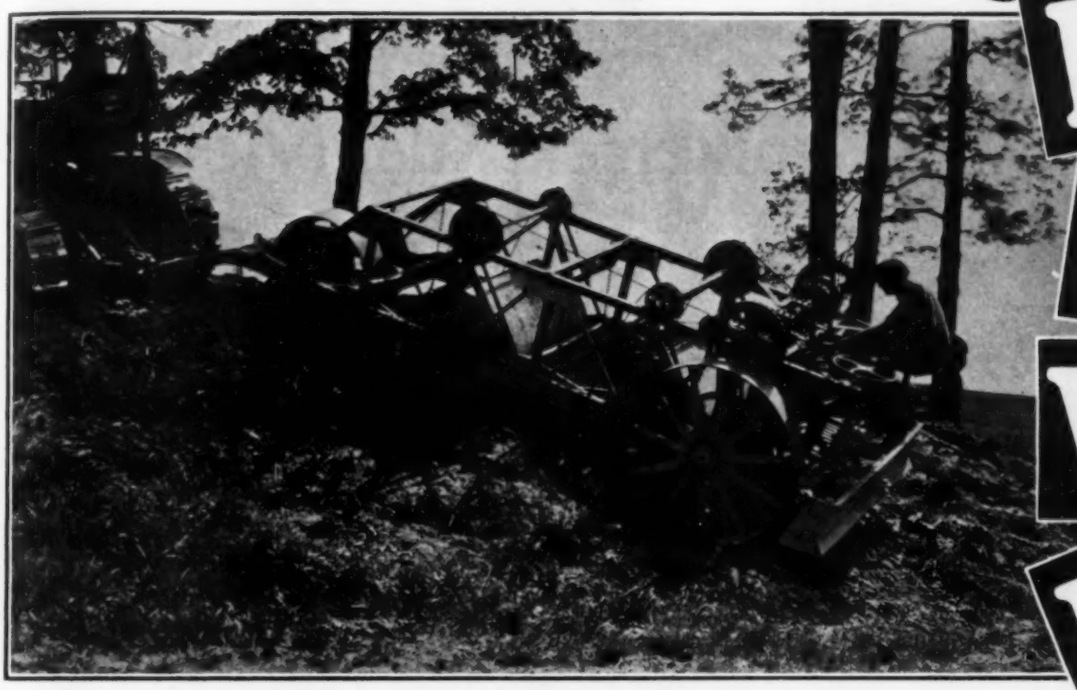
JOIN US IN THE GENERAL ELECTRIC PROGRAM, BROADCAST EVERY SATURDAY EVENING ON A NATION-WIDE N.B.C. NETWORK

200-390

GENERAL ELECTRIC

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

dirt moving costs go DOWN



Digging uphill is just usual performance for the Blaw-Knox Wagon Grader. This unit is digging, hauling and spreading topsoil at Allegheny County Memorial Park—near Pittsburgh. The contractors are Freeland, McHale & Patten.

THE BLAW-KNOX WAGON GRADER simplifies the most annoying problem in contracting---moving dirt.

Hundreds of contractors have found out that this fast moving unit will handle more yardage, with a decidedly lower initial investment.

When the Blaw-Knox Wagon Grader is put on the job to dig, load, haul, dump and spread dirt---the cost per yard *dwindles.*

fill in and mail the coupon

BLAW-KNOX COMPANY
2086 Farmers Bank Bldg., Pittsburgh, Pa.

Please send me Catalog No. 1210 THE BALL WAGON GRADER.

NAME .....
COMPANY .....
STREET .....
CITY ..... STATE .....

BLAW-KNOX

For Jobs Like These . . .

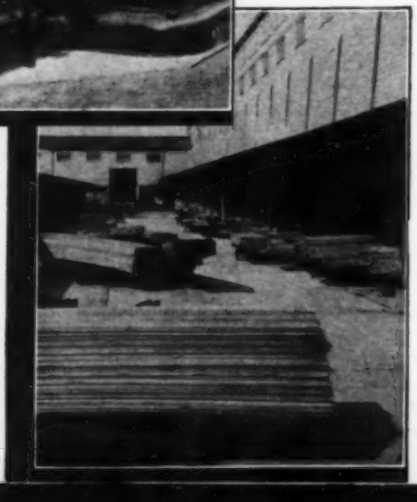
Use High-Early-Strength Concrete made with

Universal Atlas Methods and Cement

1 *This High-Early-Strength concrete conveyor pit at yard of Indiana Harbor Lumber and Coal Co. was ready for use in 3 days.*

2 *High-Early-Strength concrete bridge, near Tupper Lake, N. Y., safely carried 5-ton trucks 3 days after concrete was placed.*

3 *39-ton synchronous condenser in operation on High-Early-Strength concrete foundation at plant of Syracuse Lighting Co., Syracuse, N. Y. Average compressive strength at 3 days—3093 lbs. per sq. in.*



4 *High-Early-Strength concrete in driveway pavements at Weyerhaeuser Timber Co., St. Paul, Minn. Ready for use by steel-tired trucks in 3 days.*

WHEN you can speed up a concrete job, you are rendering a service to your company, your client or the public.

High-Early-Strength concrete, made with Universal Atlas methods and cement, has been used for several years by well-known engineers and contractors to save time and secure denser, more durable and more watertight concrete. Bridges, pavements, sidewalks, floors, building foundations are ready for use in days instead of weeks when High-Early-Strength concrete is used.

The booklet offered below shows in detail how to obtain High-Early Strength concrete with the same standard portland cement as furnished by the Universal Atlas Cement Co. for regular work. Send for a copy and offer your company or clients this time-saving service.

26

Universal Atlas Cement Co.
208 So. La Salle Street, Chicago

Without obligation, please send me booklet giving full details for securing High-Early-Strength concrete with Universal Atlas methods and cement.

Name _____

Address _____

C. M. 9-30

Universal Atlas Cement Co.

Subsidiary of United States Steel Corporation

Concrete for Permanence

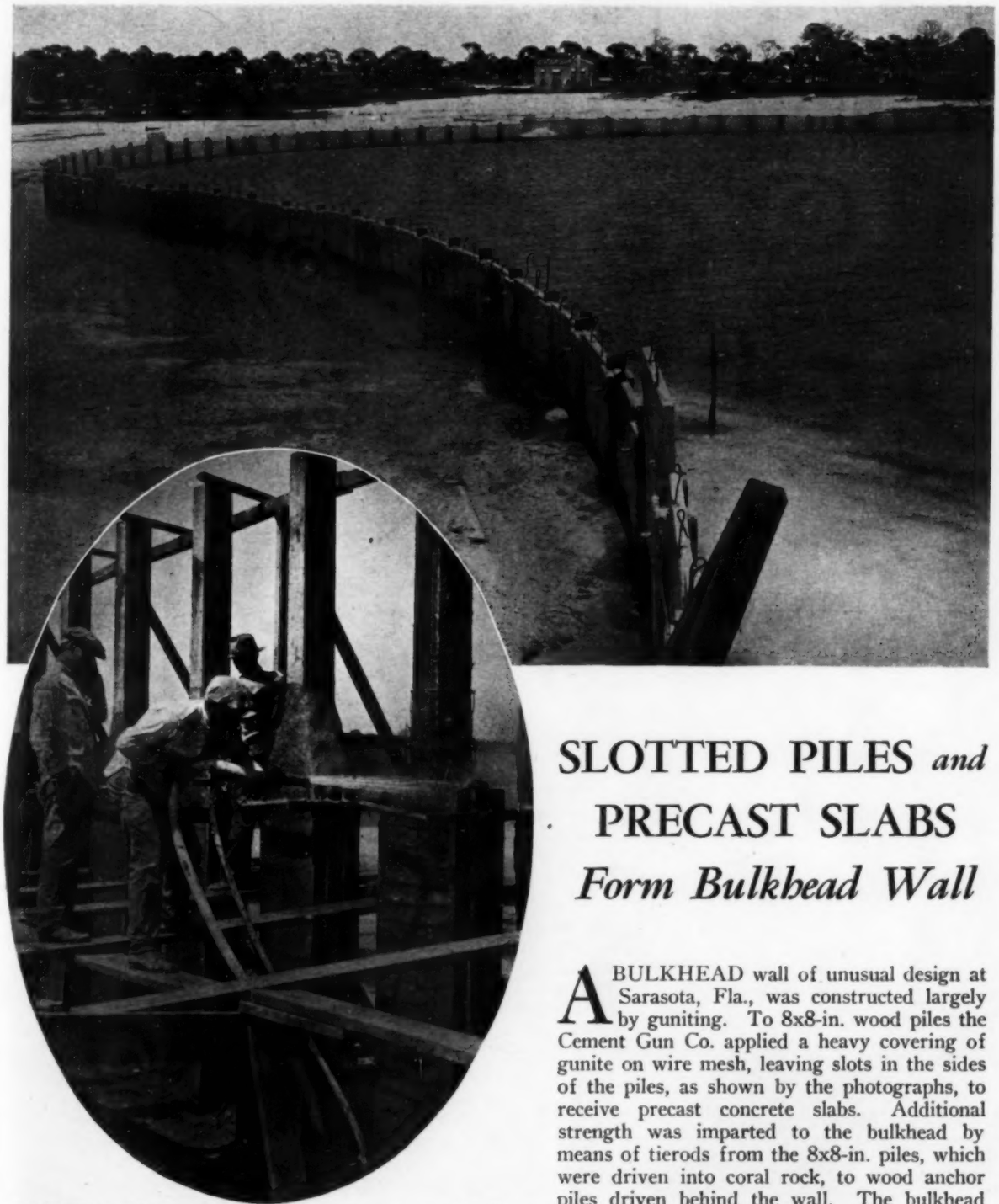
OFFICES IN: Chicago, New York, Philadelphia, Boston, Newark, Albany, Pittsburgh, Cleveland, Columbus, Minneapolis, Duluth, St. Louis, Kansas City, Des Moines, Omaha, Oklahoma City, Birmingham and Waco.

Construction Methods

A McGRAW-HILL PUBLICATION—ESTABLISHED 1919

ROBERT K. TOMLIN, *Editor*

VOLUME 12 | NEW YORK, SEPTEMBER, 1930 | NUMBER 9



BULKHEAD WALL *(above)* consists of square wood piles driven into coral rock and covered with gunite coat in which slots are formed to receive precast slabs. Coping is yet to be placed. GUNITE COAT on wire mesh is placed against box forms at sides of pile, leaving grooves for slabs.

SLOTTED PILES *and* PRECAST SLABS *Form Bulkhead Wall*

A BULKHEAD wall of unusual design at Sarasota, Fla., was constructed largely by guniting. To 8x8-in. wood piles the Cement Gun Co. applied a heavy covering of gunite on wire mesh, leaving slots in the sides of the piles, as shown by the photographs, to receive precast concrete slabs. Additional strength was imparted to the bulkhead by means of tierods from the 8x8-in. piles, which were driven into coral rock, to wood anchor piles driven behind the wall. The bulkhead was finished with a gunited coping.

This Month's "News Reel"

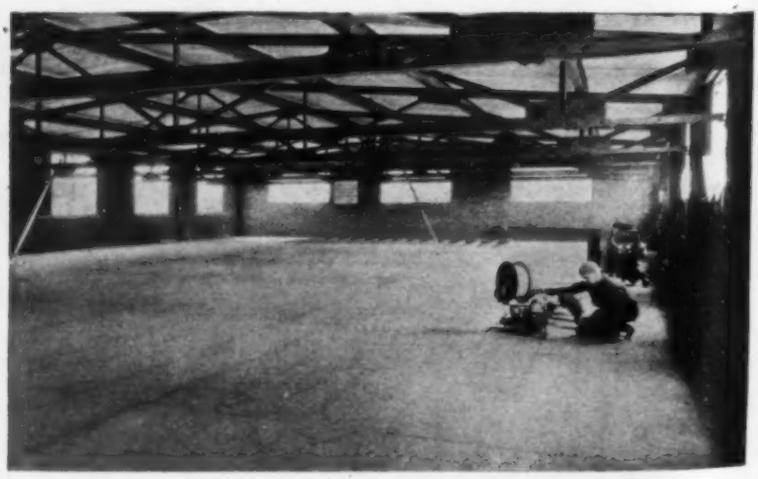
©Underwood & Underwood

CRAFTSMANSHIP REWARDED. Under auspices of New York Building Congress John D. Rockefeller, Jr., presents certificates of merit to Frank Janikowsky, stone cutter, and other workers on newly completed Riverside Baptist church. Marc Eidlitz & Sons, Inc., are the builders of the structure.

FOR CONCRETE LINING of 17-ft. diameter Cushman No. 2 water tunnel at Tacoma, Wash., Youdall Construction Co. uses Hackley collapsible steel forms in 40-ft. sections, supported on carriage 83 ft. long. Lining of 13,000-ft. bore is placed by pneumatic concrete gun.

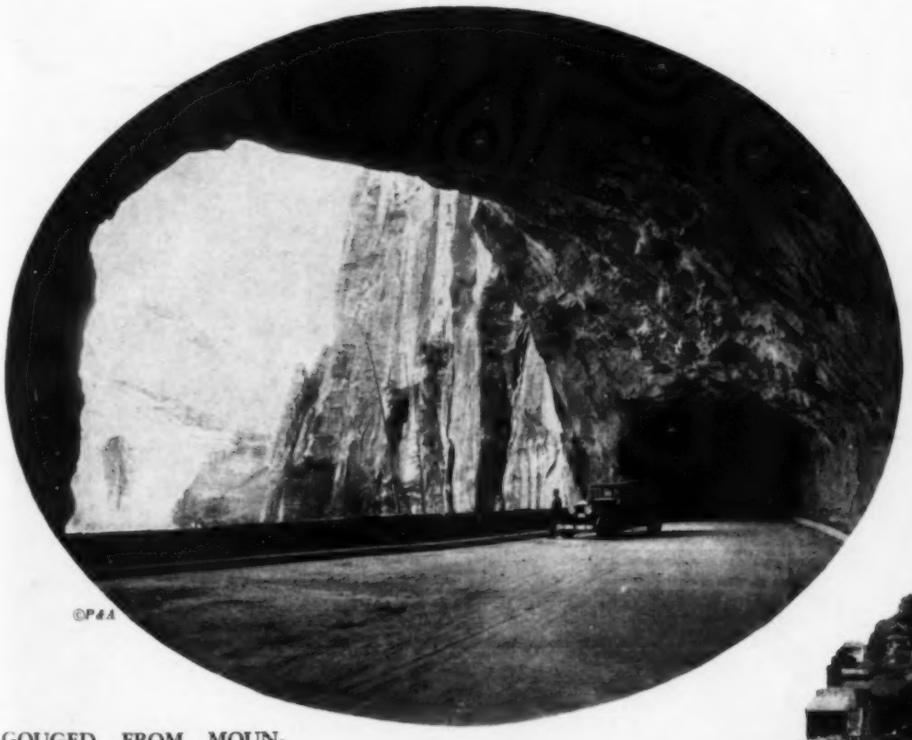
©P&A

ELEVATED EXPRESS HIGHWAY along Hudson River waterfront will bypass through traffic around congested streets of downtown New York. James Stewart & Co., Inc., contractor.

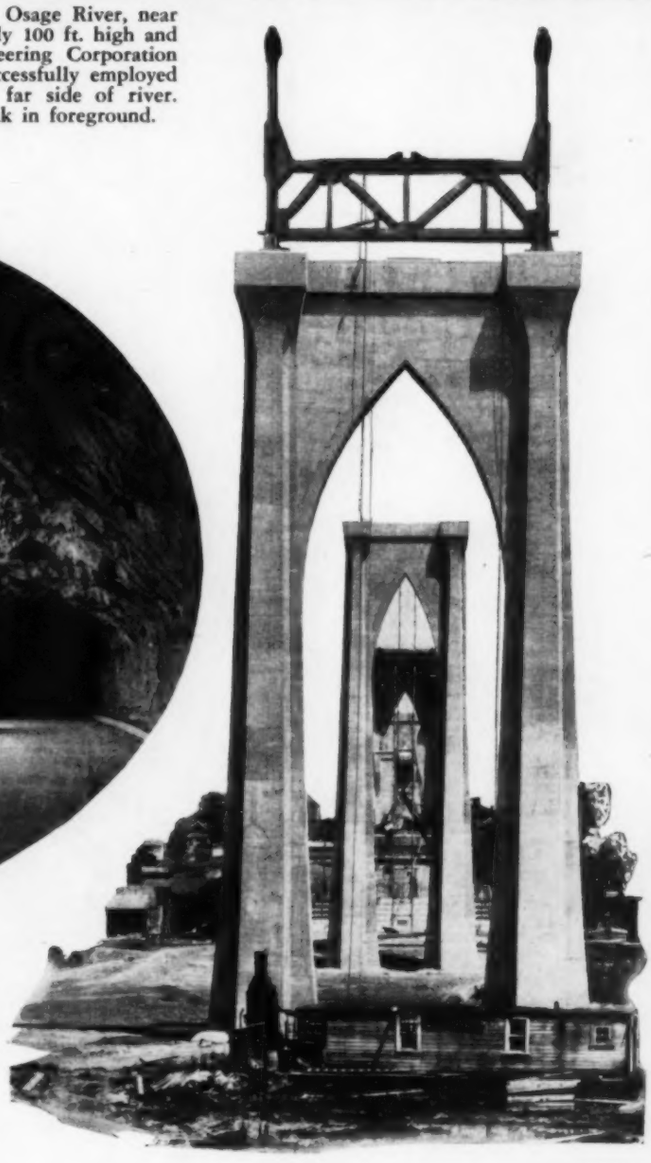


ELECTRICALLY WELDED STEEL FLOOR of new battledeck type is installed at Berkshire Garage, Pittsfield, Mass. Haarmann Steel Co. used General Electric equipment to weld floor plates ¼ in. thick and 24 in. wide to 5-in. I-beams spanning 20 ft. Floor weighs only 15.2 lb. per square foot.

OSAGE DEVELOPMENT of Union Electric Light & Power Co. on Osage River, near Bagnell, Mo., will consist of concrete and earth-fill dam approximately 100 ft. high and initial power installation of 160,000 hp. Stone & Webster Engineering Corporation is using same arrangement of steel trestle and traveling gantries successfully employed at Conowingo to distribute spillway concrete inside cofferdam on far side of river. Skid derricks are extending cellular cofferdam walls from river bank in foreground.



GOUGED FROM MOUNTAINSIDE *(above)*. Zion-Mt. Carmel highway in southern Utah, formally dedicated this summer, provides 24-mile scenic route of galleried tunnels involving unusual construction problems.



TALL CONCRETE PIERS *(right)* are completed for St. Johns bridge across Willamette River, Portland, Ore. Structure designed by Robinson & Steinman, consulting engineers, will have main suspension span of 1207 ft. Gilpin Construction Co. is the contractor.

Paving the Roadway of the MID-HUDSON BRIDGE

Planned Sequence of Slab Concreting Operations Equalizes Dead Load on Bridge Cables as Construction Progresses

IN PAVING the concrete roadway of the 3,000-ft. long Mid-Hudson suspension bridge to carry vehicular traffic between Poughkeepsie and Highland, N. Y., officially dedicated by Governor Franklin D. Roosevelt last month, Scott Brothers Construction Co., Inc., of Rome, N. Y., had to develop a construction plan and maintain a sequence of field operations which, at all times during the pouring of the concrete floor slabs, would equalize the load distribution on the two suspension cables which support the huge structure. These cables, each 16¾ in. in diameter and containing 6,080 parallel wires, are 42 ft. apart and extend from shore anchorages over two 315-ft. steel towers on river piers. The main suspension span is 1,500 ft. long and the two end spans each 750 ft. long.

The concrete roadway, 30 ft. wide between curbs, is 8 in. thick and is heavily reinforced with built-up mats of ½-in. steel rods. The reinforcing rods are arranged in two layers, or grids, one staggered over the other, so that there is a transverse steel rod every 2 in. In addition, there is a 4½-ft. concrete sidewalk 3-in. thick for pedestrians on each side of the roadway. The reinforced concrete roadway and sidewalks impose a dead load of 4,000 lb. per linear foot of bridge. For the 3,000-ft. length of the bridge a total of about 270 tons of steel reinforcement was required for the roadway.

The steel floor system of the bridge on which the concrete roadway slabs are carried comprises heavy floor beams 20 ft. 10 in. apart and seven lines of 22-in. I-beam stringers spaced 4 ft. 8 in. apart on centers.

Three-Strip Paving—As developed by H. M. Sherwood, superintendent for Scott Bros., the construction plan provided for paving the

TO EQUALIZE LOAD of roadway paving on bridge, center strip was poured first, then outer strips, alternating from side to side.

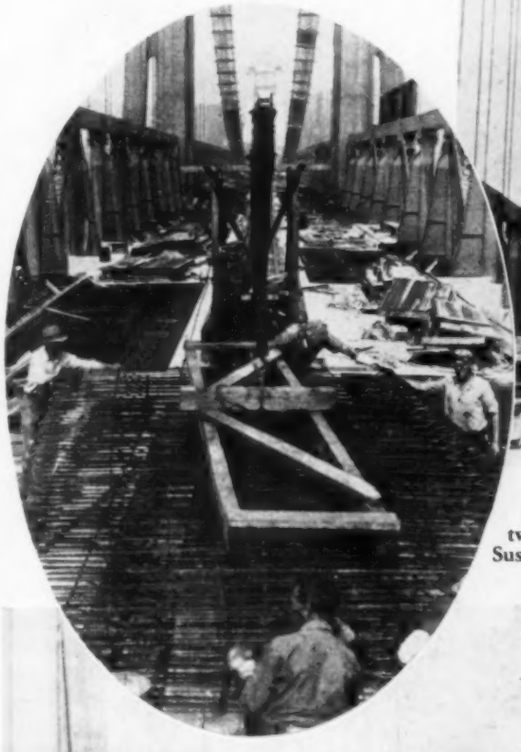
H. M. SHERWOOD *(below)*, superintendent for Scott Bros. Construction Co.

L. G. LITCHFIELD *(below)*, secretary, Scott Bros. Construction Co.

3,000-ft. length of bridge roadway in three strips, the center one being 9 ft. 4 in. wide and the two side strips each 11 ft. 1 in. wide. The plant layout was based on the decision to employ industrial railway haulage to deliver concrete from two mixing plants, one at each end of the bridge.

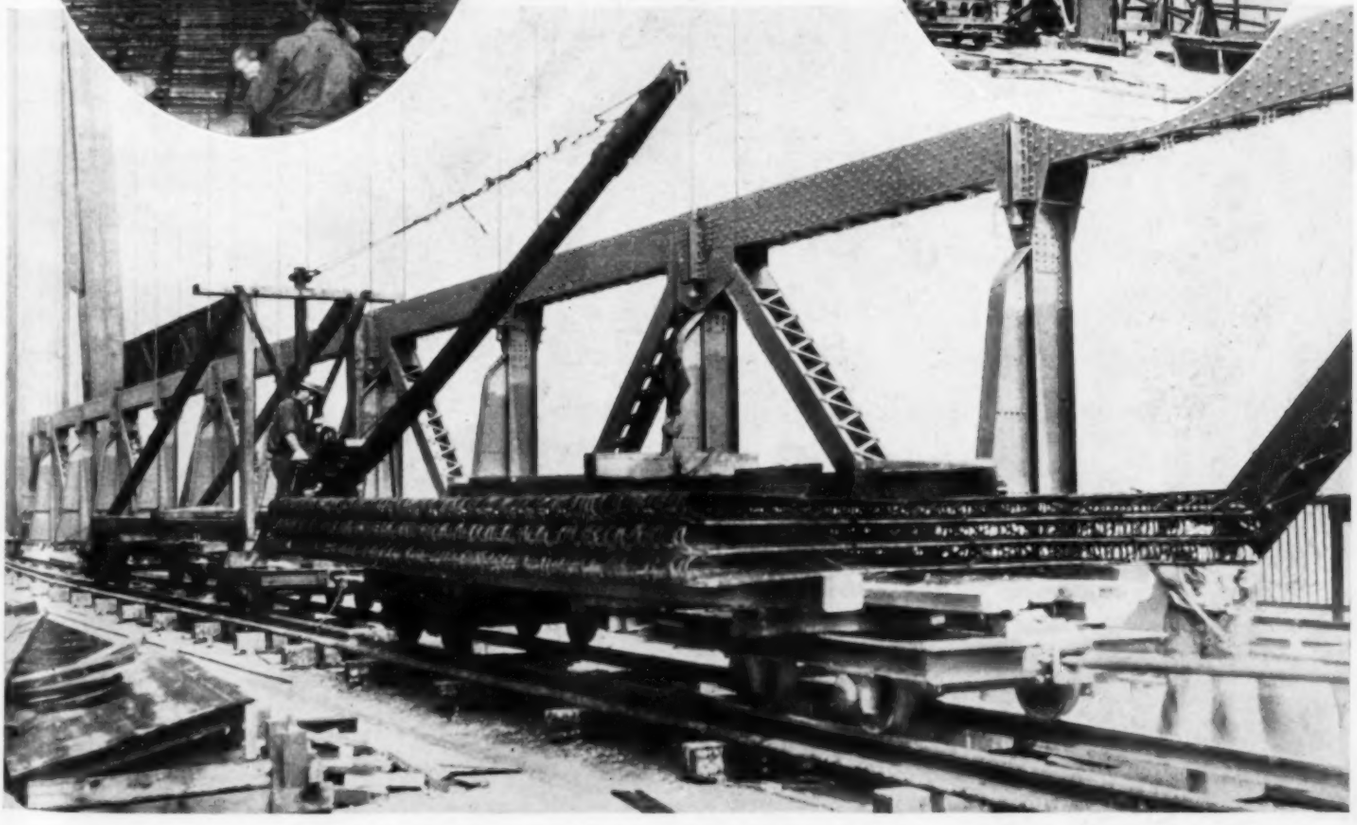
The preliminary study of the job indicated that the "bottleneck" controlling paving progress would be the fabrication and placing of the heavy slab-reinforcing mats, rather than the mixing or delivery of concrete. At the Highland end of the bridge, therefore, early efforts were concentrated on the installation of a row of wood templet frames for spacing and wiring up the steel-bar reinforcing mats. L. G. Litchfield, secretary of the con-

TIMBER SPREADER *(below)*, **with hooks, prevents distortion of reinforcement mats when handled by derrick car.**



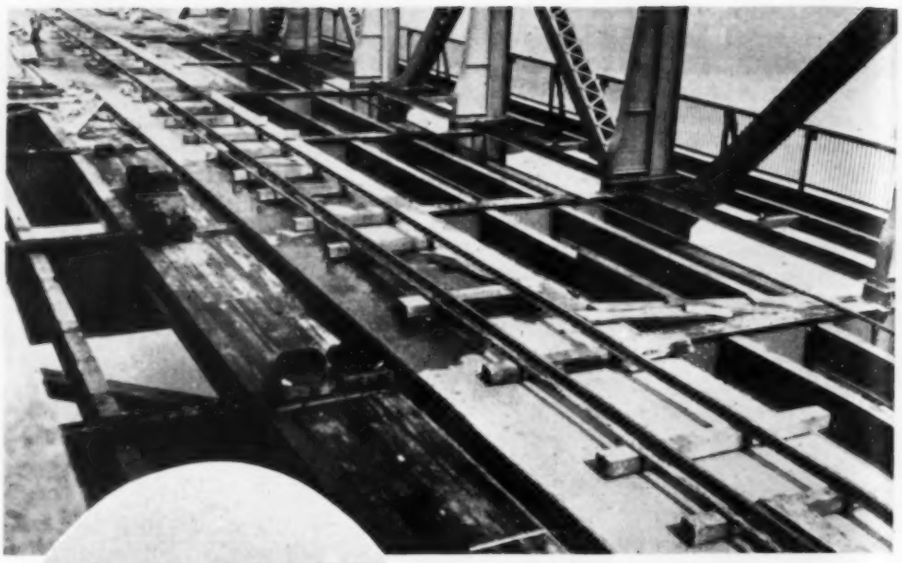
MID-HUDSON BRIDGE has roadway 30 ft. wide between curbs and 3,000 ft. long. Suspension cables are carried by two 315-ft. steel towers.

TOWER HOIST *(below)* **raises concrete from mixer to chute discharging into wheel-mounted hopper cars.**



HEAVY BUILT-UP MATS of steel reinforcement for the concrete roadway are delivered by industrial railway on completed center strip and swung to place by boom of derrick car.

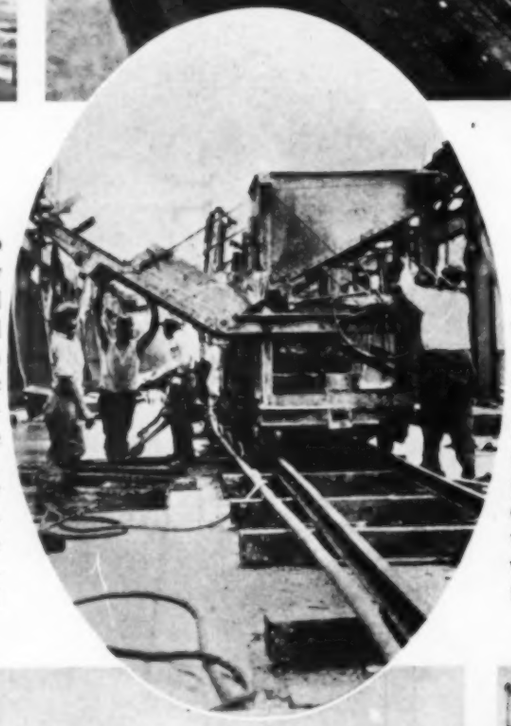
STEEL REINFORCEMENT for floor slab and forms for curb in place.

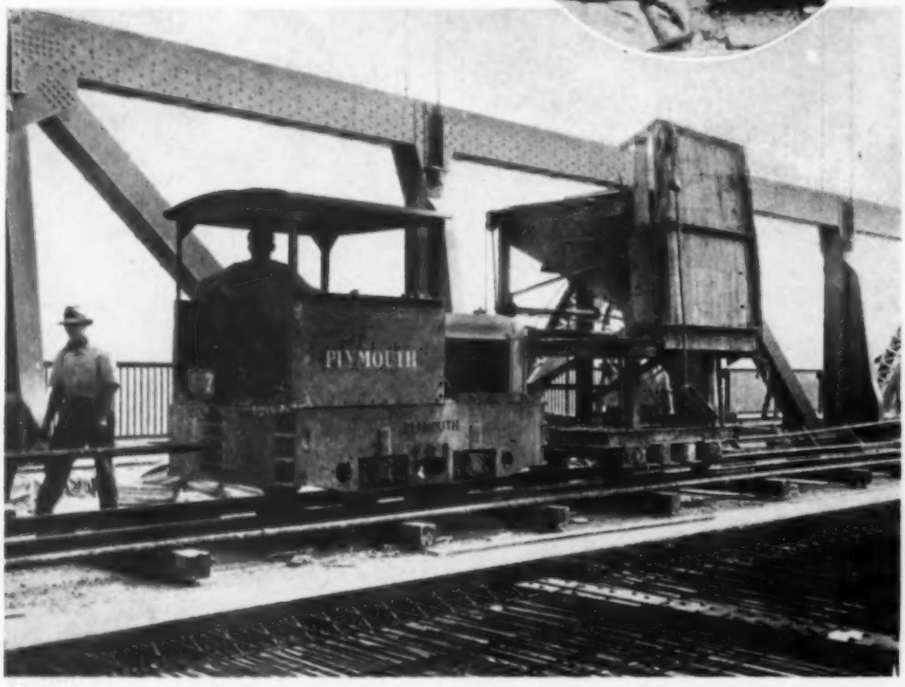


NARROW-GAGE TRACK was first laid alongside and later upon the completed center strip of paving. Note, at left, line of form panels between bridge stringers, serving as working platform.

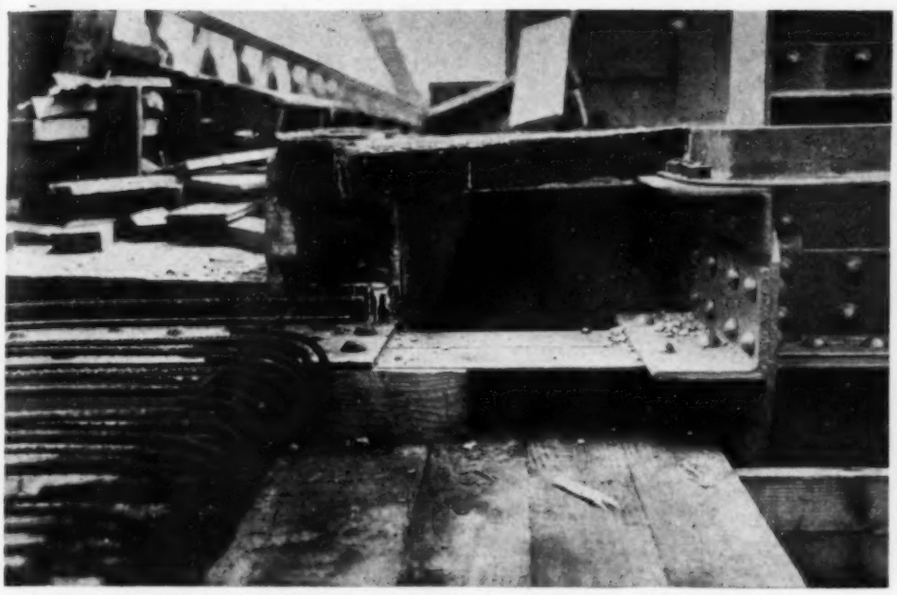
tracting company and in charge of job administration, procured early delivery of the necessary tonnage of steel bars and, before other operations had speeded up, work was in full swing on the fabrication and storing of the steel-bar reinforcing mats at the contractor's Highland yard. At the same time a sawmill was set up and 4-ft. wooden panels 10 ft. long for the floor forms were built. By thus anticipating the critical needs of the work the contractor had an ample supply of reinforcing mats and form panels stored and ready to serve the slab pouring operations when they began.

In preparation for slab concreting a single, narrow-gage railway track was installed the full length of the bridge and immediately alongside of the 9-ft. 4-in. center strip of concrete paving. On the other side of the center strip a line of form panels, 4 ft. wide between pairs of bridge stringers, was placed to serve as a working platform. Wooden forms for the center

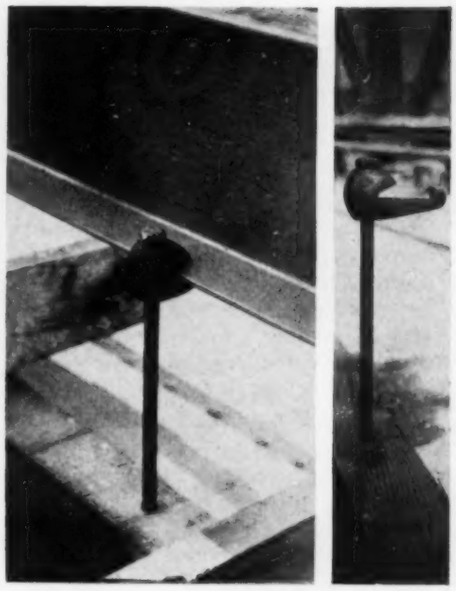




HOPPER CAR, hauled by gasoline locomotive *(above left)*, delivers concrete directly to forms by gravity *(above right)*. HINGED CHUTE *(in oval)* is folded up out of the way while car is in transit.



CONCRETE CURB DETAIL, showing junction with roadway paving, and bent ends of slab reinforcing mat. The vehicular roadway is 30 ft. wide between curbs and the sidewalks each 4½ ft. wide.



SPECIAL CASTING and rod were devised to hang outside forms to lower flange of channel member.

strip were then placed between the I-beam stringers and concreting was done in sections 41 ft. 8 in. long, equivalent to two bridge panels.

To prevent unequal loading on the bridge as paving operations progressed, the scheme followed was, first, to concrete the center strip of roadway, starting in the middle of the bridge and working toward both ends. With the center strip concreted the second operation involved shifting the narrow-gage track on to the completed slab. Again starting from the middle of the bridge and working toward its ends, alternate panels of the outside roadway strips were poured, first on one side of the center strip and then on the other, leaving rows of staggered gaps, as shown in the illustration on page 32; this constituted the third operation in the series. The fourth and last operation consisted in going back to the middle of the bridge, shifting the forms laterally, and concreting the gaps between alternate panels, again pouring first on one side and then on the other to distribute the weight of the roadway uniformly.

Hopper Car—The concrete mixing plants, one at each end of the bridge, were of standard design, consisting of 14-cu.ft. Jaeger mixers and tower hoists which delivered through inclined chutes into special hopper cars mounted on flanged-wheel trucks and hauled by Plymouth gasoline locomotives to the roadway forms. Details of the hopper cars, as designed by Mr. Sherwood, are shown in the photographs on page 34. Each holds 1½ yd. of concrete and is elevated on a steel frame so that concrete may be discharged to the roadway forms by gravity. Delivery is controlled by a gate in the side of the elevated hopper and by a hinged apron or chute which is folded up out of the way while the car is in

SCREEDING outer strip of roadway with steel channel equipped with handles. Note railway track, locomotive and concrete hopper car on completed center strip. Also 2-in. water pipe line for curing concrete.

transit to and from the mixer. After being worked in around the reinforcing bars and vibrated by an air calking-hammer held against the forms, the concrete is screeded by hand, using a length of channel iron fitted with handles.

Both transverse and longitudinal joints are formed by premolded strips of Servicesized fibrated asphalt ½ in. thick. Curing of the concrete slabs is accomplished by covering with burlap and sprinkling, using water from a 2-in. line extending the entire length of the bridge.

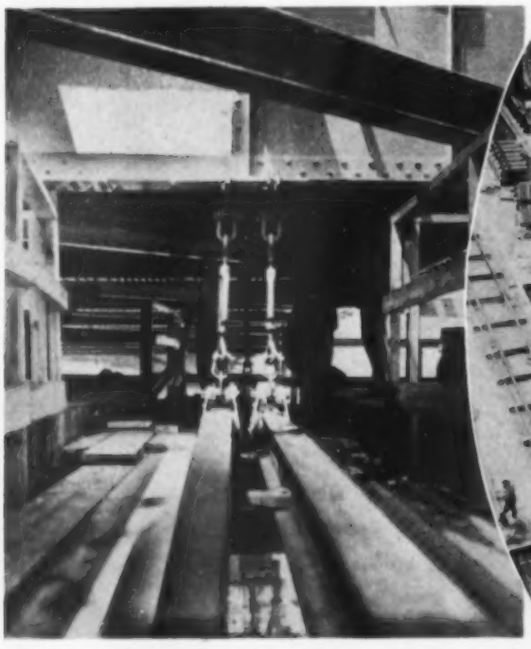
Derrick Car — For delivering and placing the steel bar reinforcing mats, each weighing about 1,400 lb. and measuring 20 ft. 10 in. long and either 9 ft. 2 in. (for the center strip) or 10 ft. 10 in. (for the outside strips) the contractor used a derrick car with 30-ft. boom, as illustrated. To prevent the mats from buckling while being raised from the flat-cars and lowered to place, a stiff wood frame or spreader with grapple hooks was employed.

Trolley Scaffolds—A feature of the form-handling equipment for the floor slabs was a special hanging trolley scaffold, another product of Superintendent Sherwood's ingenuity. Four of these scaffolds were in use, each with a working platform 60 ft. wide, amply covering the entire width of the bridge, and 24 ft. long. The scaffold is hung underneath the bridge floor by rods and grapples which engage the lower flanges of the steel floor beams. With a clearance of about 5 ft. below the bridge steelwork, the scaffold furnishes a convenient platform for setting and shifting the forms for the concrete roadway.

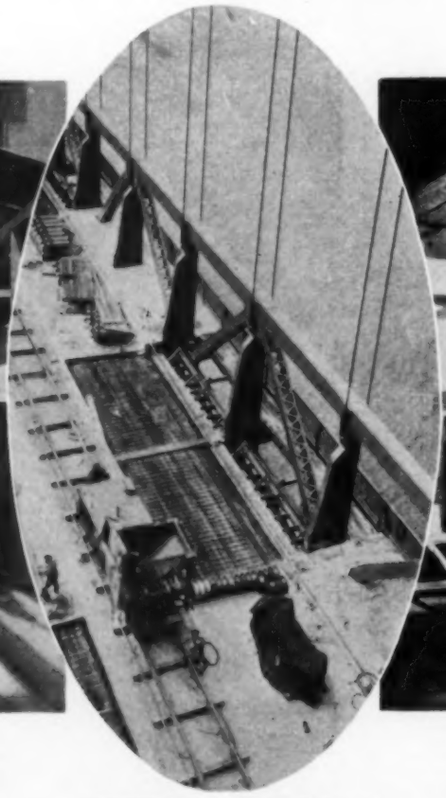
HINGED END of rack for fabricating reinforcement is lowered to permit easy removal of built-up mat.

Each scaffold consists of flooring supported on each side by a pair of 10-in. I-beams, 66 ft. long. The top flanges of the I-beams ride on the wheels of eight trolleys, each trolley being hung from a rod made extensible by turnbuckles. At the top of each rod is a grapple to engage the bridge floor beam, as illustrated on this page. When the scaffold is to be moved the rear grapples are loosened, successively, and rolled ahead on a wheeled truck device to the next floor beam, to which they are clamped. The 66-ft. long I-beams, which act as cantilevers during a shift of the scaffold, are then pulled ahead by block and tackle, rolling on the wheels of the hanging trolley grapples. Angle-iron safety stops on the main I-beam supports prevent moving the scaffold until the trolleys are properly placed. This scaffold rig has proved most effective in helping to shift the roadway forms. Its ease of operation is indicated by the fact that a scaffold has been shifted as many as 34 times in 10 hours while placing forms. Forms for a 20-ft. and 10-in. length of roadway strip are set in 15 min.

The Mid-Hudson bridge was built under the general direction of Col. Frederick Stuart Greene, superintendent of the New York State Department of Public Works, with L. S. Hulburd acting as resident engineer. The consulting engineers were Modjeski & Moran, with C. W. Hanson as representative on the work. For Scott Bros. Construction Co. of Rome, N. Y., on the roadway paving contract, L. G. Litchfield, secretary of the company, and H. M. Sherwood, superintendent, were in charge.



HANGING SCAFFOLD, underneath bridge, provides working platform for handling roadway forms. It carries a platform 60x24 ft., supported by long I-beams from trolley hangers.



ALTERNATE SECTIONS of roadway strip are concreted in lengths of two bridge panels (41 ft. 8 in.).

REMOVING GRAPPLE to shift hanging scaffold. Note turnbuckles on suspension rods and trolley wheels on which upper flanges of I-beams roll.

COMPACT FORM

Gives Detailed Summary of Highway Costs

FOR highway contractors the blank form reproduced on this page offers a convenient means of keeping an accurate and condensed record of construction costs and administrative expenses on each job. It is one of the standard forms of the Bricon Construction Co., Inc., of Indian Lake, N. Y., and has been placed at the disposal of members of the New York State Highway Chapter of the Associated General Contractors of America by John D. Rust, president of the Bricon company. Many contractors who have incorporated this form in their cost accounting systems recommend it highly. As presented herewith, the form is considerably reduced in size for convenience in printing.

Wanted: Other Cost Forms

The Editor of "Construction Methods" will be glad to receive from contractors and engineers other blank forms that have proved effective in determining and classifying the actual cost of the job.

CONTRACT ITEMS FROM PROPOSAL			PRODUCING LABOR		COST OF MATERIALS					
					IMPORTED		LOCAL			
No.	ITEM	UNIT	QUANTITY	UNIT	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL	BID PRICE	TOTAL

RECAPITULATION COST OF ROAD	
Total Cost of Imported Materials	
Total Cost of Local Materials	
Total Cost of Materials	
Total Cost of Labor	
Construction Expense Fixed	
Construction Expense Current	
Construction Expense Total	
Administrative Expense	
General Expense	
Financial Expense	
Total Overhead Expense	
Total Cost of Road	
Prospective Profit	
Total Bid Price	

CONSTRUCTION EXP. FIXED	ONE YEAR	NO YRS.	TOTAL
Fire Insurance			
Taxes			
Bonds			
Compensation Ins			
Public Liability			
Total			

CONSTRUCTION EXP. CURRENT	ONE YEAR	NO YEARS	TOTAL
Fuel (Coal etc)			
Gas & Oil			
Machinery Parts			
Construction Supplies			
Trucking Exp & Rentals			
Erecting Plant			
Freight on Plant			
Demurrage			
Supt Exp (Not Salary)			
Dynamite			
Fuse etc			
Temporary Buildings			
Depreciation on Plant			
Total			

ADMINISTRATIVE EXPENSE	ONE YEAR	NO YEARS	TOTAL
Office Salaries			
Office Supplies & Exp			
Office Rent			
R R Transportation			
Motor Transportation			
Hotel Expense			
Legal Expense			
Telephone & Telegraph			
Medical Service			
Executive Insurance			
Employ Bureau Exp			
Timekeeper Salary			
Engineer Salary			
Advertising			
Donations			
Supt Salary			
Executive Salaries			
Total			

GENERAL EXPENSE	ONE YEAR	NO YEARS	TOTAL
Taxes (Income)			
Commissary Loss			
Commissary Salary Loss			
Total			

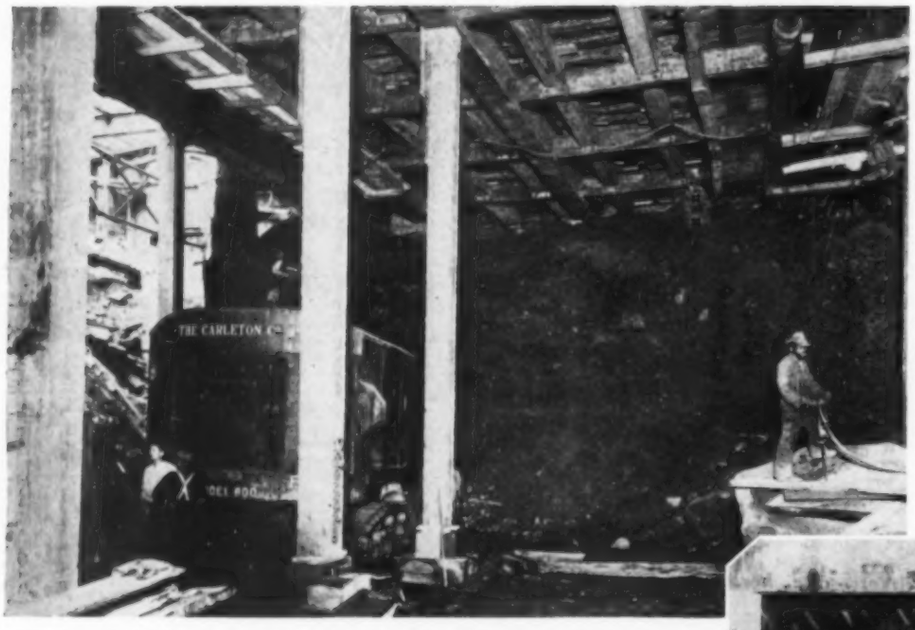
FINANCIAL EXPENSE	ONE YEAR	NO YEARS	TOTAL
Interest on Notes			
Discount on Notes			
Total			

Building New York's Subways—II

Many Types of POSTS Support Street Decking

SUPPORTS for the many decking systems illustrated in last month's *Construction Methods* are of two kinds: those installed before excavating and those placed after excavation has been carried to subgrade. In rock cuts, where solid footing is assured at all levels, posts usually are carried down with the excavation. In earth, however, contractors often install them before making the subway cut under the decking.

Timber still is the most favored ma-



ONE TYPE OF POST in soil of good bearing value is 12x12-in. timber resting on precast concrete pad placed after shovel excavates to subgrade. Blocks and shims are used under post. Shovel needs space to load trucks at face of cut. Heavy longitudinal girders, welded continuous, of Carleton Co., Inc., carry decking over long span at face. LONG GIRDERS ON DECKING *(right)* give added support, by suspender rods, to beams carrying decking where span is of especially great length.

STEEL TOWERS, columns of which are driven to necessary penetration prior to excavating, support decking of Corson Construction Corporation. This method eliminates posting while excavation is in progress.

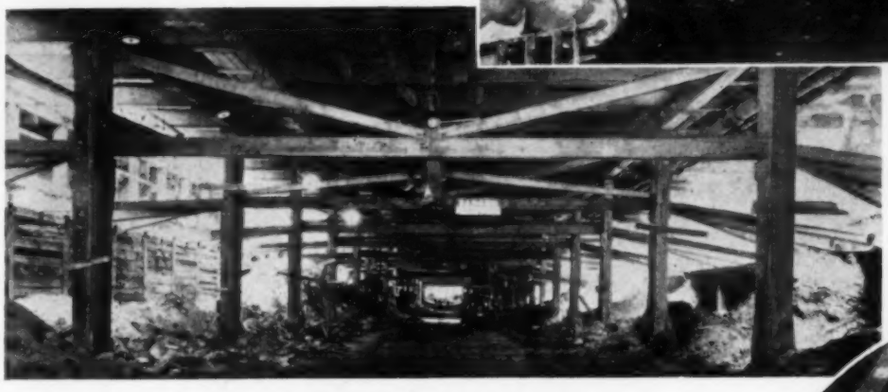
TIMBER TOWERS, consisting of four 12x12-in. posts, carry cross-braces and decking of Frederick L. Cranford—Charles H. Locher, Inc., in earth and rock cut. In rock, towers are carried to subgrade after excavating.

Second of a Series on Construction of New York City's Third Underground Rapid Transit System

terial. When wood posts are installed in advance, it is necessary to sink sheeted pits to subgrade to place the footing blocks and posts. Steel beams are coming into wide use because the contractors can drive them to the desired penetration, saving the cost of the pits.

The relative merits of installing posts before or after excavating, and of steel as compared with wood, depend largely on conditions found on the individual contract section.

ERECTING POST under transverse beam on another Carleton Co. contract section after shovel has advanced face of cut. Where transverse girders are placed under longitudinal beams of decking system, stirrups hung from longitudinals support transverse beams until posts can be set.



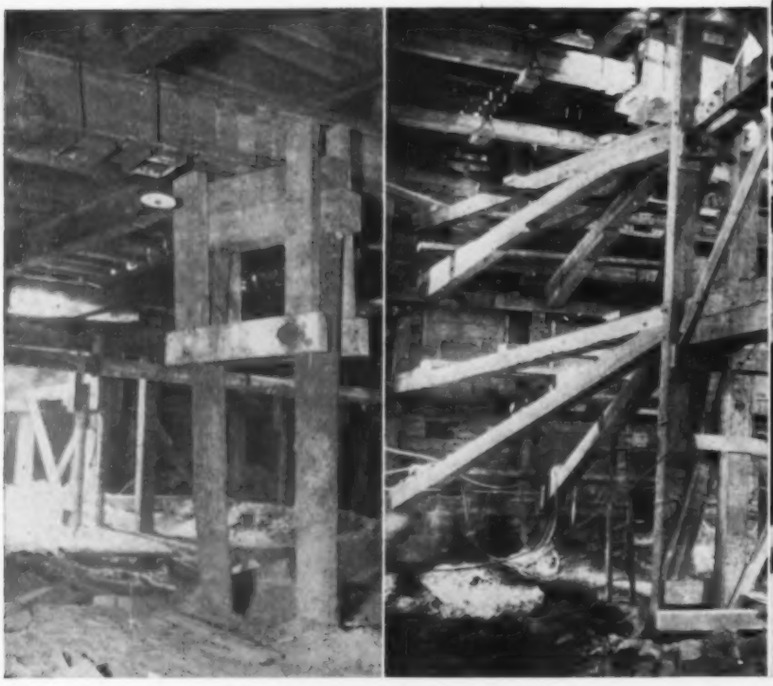
TWO-POST TIMBER TOWERS under longitudinal girders carry decking system for Triest Contracting Corporation on contract section of W. G. T. Construction Co., Inc.

STEEL COLUMNS, driven prior to excavating, support longitudinal girders of Heyman & Goodman Co., Inc., and allow great freedom in removing posts under transverse beams to clean up berms along sides of cut.

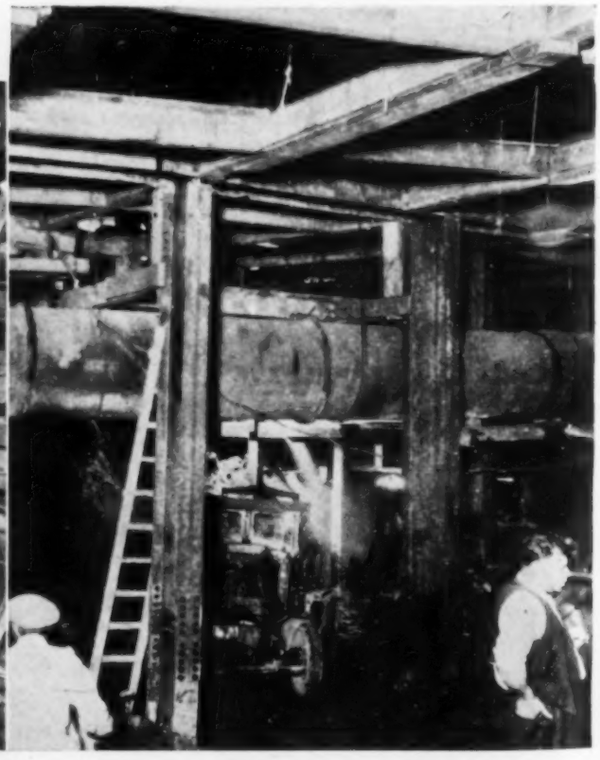
SHORES carried on sides of narrow rock cut leave clear space for operation of power excavators by T. A. Gillespie Co. Tile ducts of telephone, telegraph, and electric power cables are replaced with wood boxes. Underside of water main is sheathed as protection against flying rock.

LONG, BUILT-UP COLUMNS of four 12x12-in. timbers have sufficient lateral stiffness to support decking without cross-bracing in deep rock cut of La Rocca Construction Corporation.

STEEL BEAMS, spanning cut for depressed track, carry two-post timber towers under decking, leaving clear roadway on upper level and space for operation of tunnel mucker and trucks on lower level of Di Marco & Reimann, Inc., contract section.



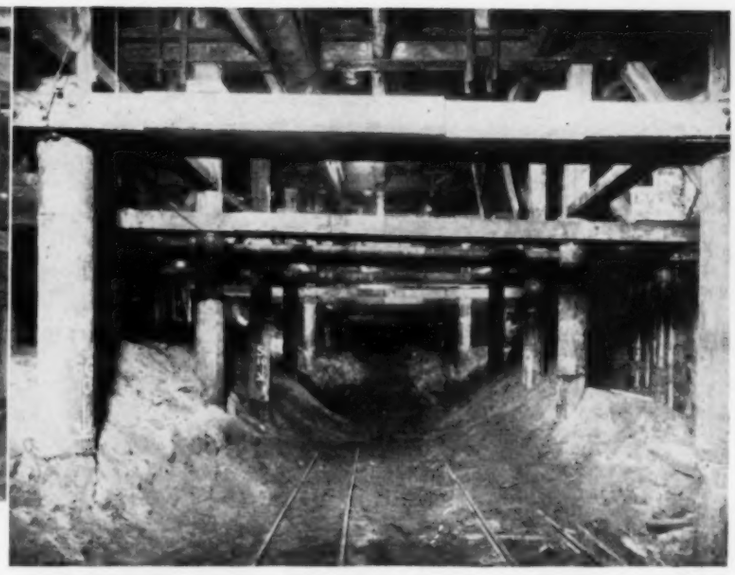
TO SAVE CHANGING OF POSTS as excavation is carried down by hand labor on section of W. G. T. Construction Co., Inc., where close spacing of underpinning towers forbids use of power excavators, Triest Contracting Corporation drives wood piles almost to subgrade to carry decking. TIMBER TOWERS *(right)* on concrete pads replace wood piles when excavation reaches subgrade.



HEAVY STEEL BEAMS, driven to below subgrade in sections, with bolted splices between sections, from bottom of first lift along center of deep, wide cut on J. F. Cogan Co. contract section carry steel beam, laid flat, along which timber posts and cross-braces can be placed at any point as needed. Excavation is to be carried 16 ft. below bottom of first lift.

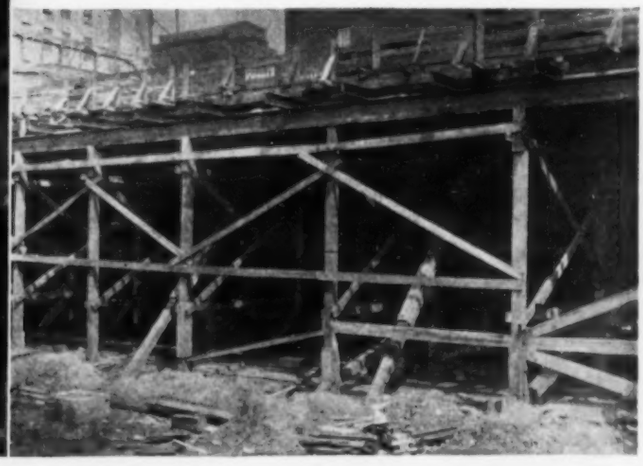
Subways—Part II (continued)

FOUR-POST TOWERS, widely spaced and erected in sheeted pits prior to excavating, give ample opportunity for shovel and truck operation on Atwell-Gustin-Morris, Inc., contract section. Vertical sheeting through center of towers on right retains earth for track on higher level. Concrete protection floor has been placed.

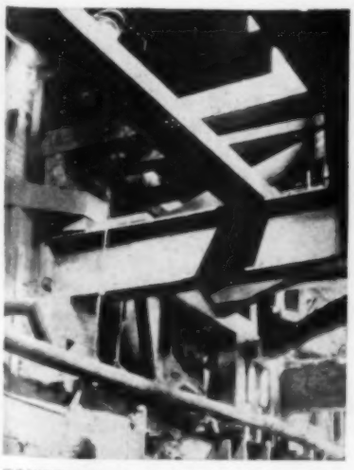


IN WATER-BEARING SAND of low bearing power, pretest pipe piles driven below subgrade by Spencer, White & Prentis, Inc., for Marcus Contracting Co., Inc., before excavating, eliminate necessity of changing posts as excavation proceeds and avert danger of settlement in poor soil.

COMMON METHOD of supporting street decking by timber posts resting on concrete pads is used by Del Balso Construction Corporation in cut bounded on one side by basement and underpinned walls of buildings. On other side, property has been cleared of buildings. See two photographs below.



CROSS-BRACING is particularly important where single-timber posts carry decking system devoid of bank support. Necaro Co., Inc., uses diagonal and horizontal ties. Rakers under decking are shoring building walls.

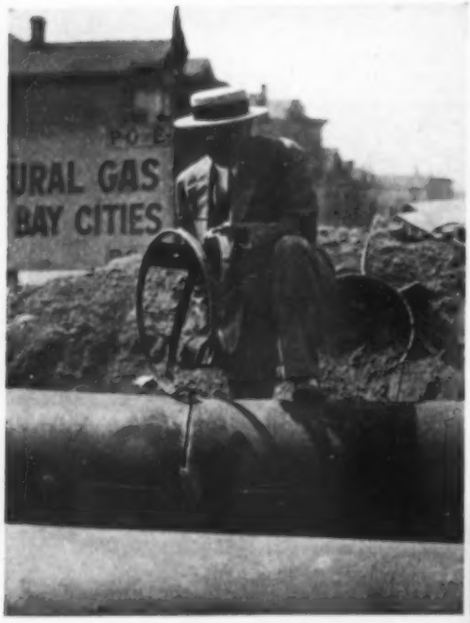


WHERE UNDERPINNING *(left)* beneath building walls can be used to carry transverse beam of decking system, Del Balso Construction Corporation places concrete support for beam on top of underpinning.

BEFORE EXCAVATING *(right)* Del Balso Construction Corporation places timber posts in box-sheeted pits, resting posts on concrete pads at subgrade. Excavation then goes down without interruption caused by replacing of posts.

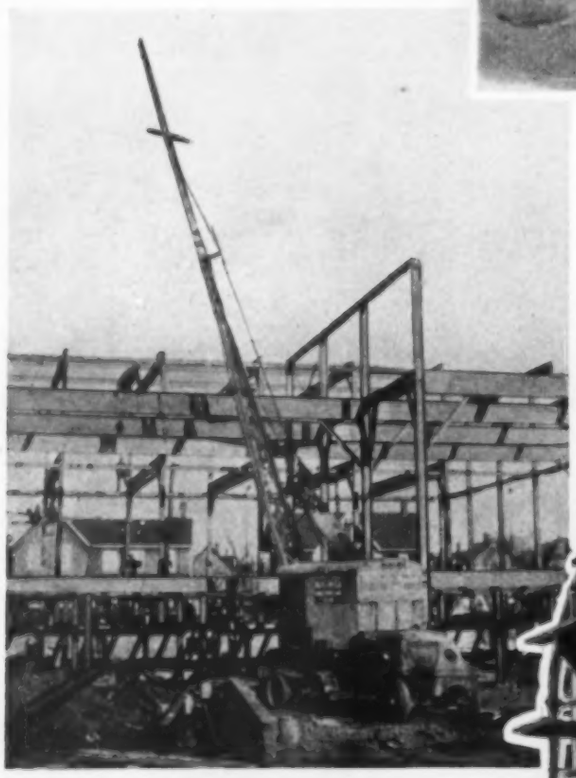
Getting Down to

DETAILS



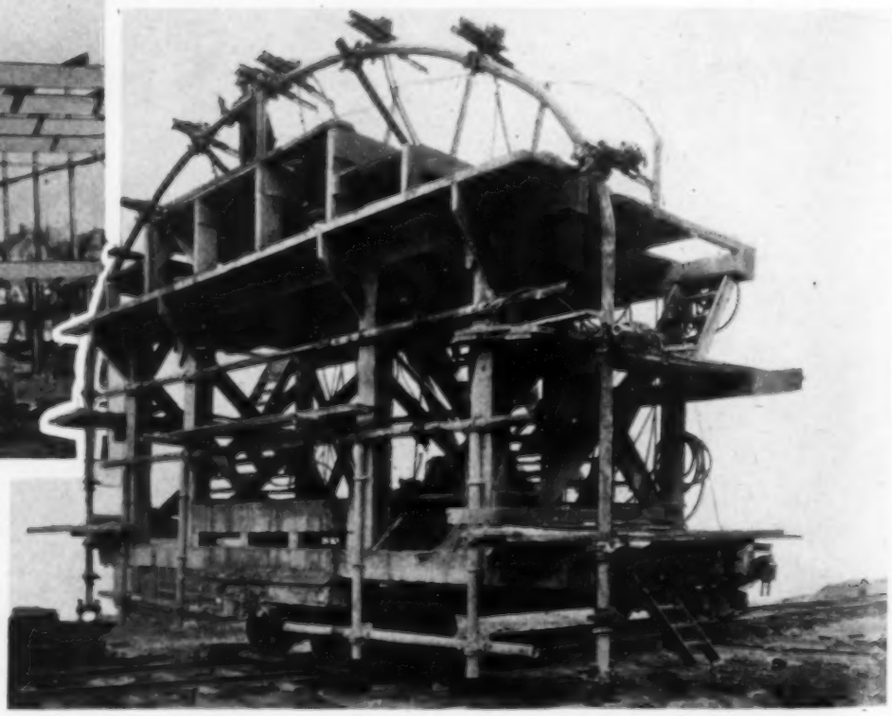
HINGED TEMPLET, made from 22½-deg. gore cut out of 20-in. pipe, aids Pacific Gas & Electric Co. in cutting pipe with oxy-acetylene torch to make bends.

GRAVITY MATERIAL-HANDLING PLANT in favorable location eliminates need for crane on paving section between Spokane and Larsung Hill being built for Washington State Highway Department, Samuel J. Humes, director. Sand and gravel flow from cars to bunkers, to measuring hoppers, to trucks.



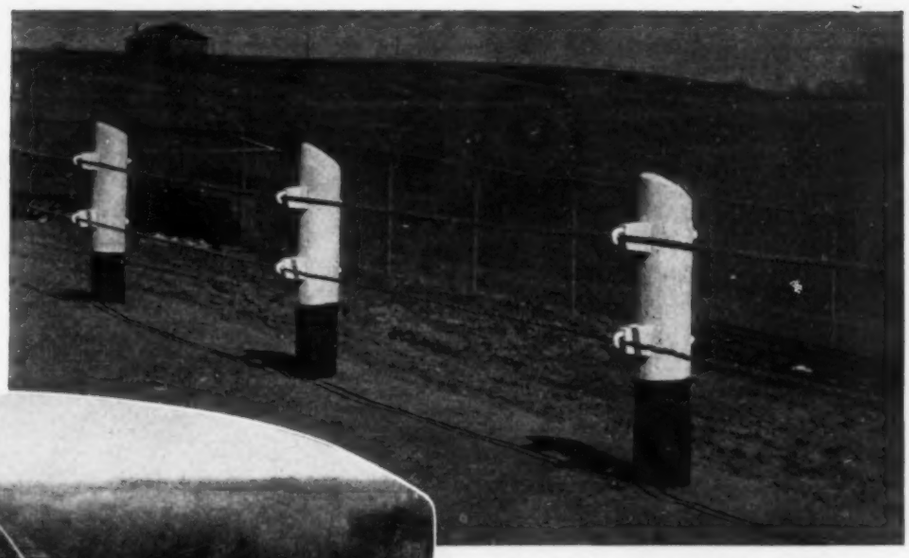
LONG BOOM of Universal crane sets steel for McClintic-Marshall Co. on Staten Island, N. Y., silk mill building. Boom consists of original 28-ft. boom, 8-ft. heel extension, 16-ft. jib, and 15-ft. jib extension, giving total length of 67 ft. Detachable crawlers carry crane over rough or poor ground.

Photograph from
WILLIAM G. RAPP
McClintic-Marshall Co.

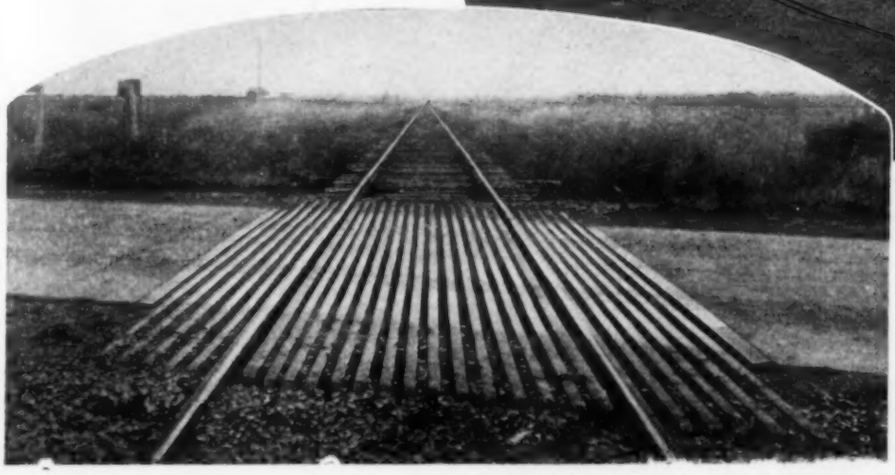


DRILL CARRIAGE used by Walsh Construction Co., Davenport, Ia., in rim-drilling and broaching new Breakneck double-track tunnel of New York Central. Tunnel passes within 50 ft. of east shaft of Catskill aqueduct under Hudson River, making careful operations necessary.

Close-up Shots of Job Methods and Equipment



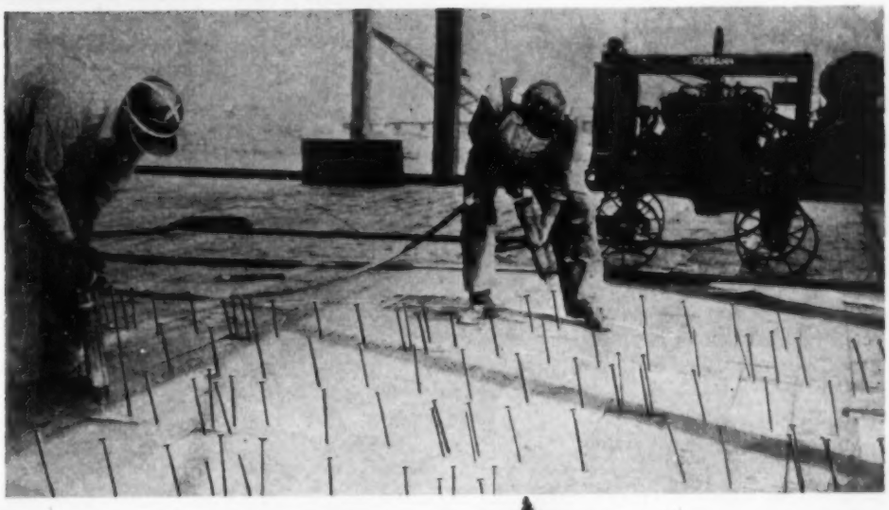
CABLES OFFSET FROM POSTS by iron blocks prevent hubs of vehicle wheels from striking posts of Pennsylvania guard rail. Two wire ropes, 1-in. upper and ¾-in. lower, anchored in concrete deadmen, can stop fast-moving truck.

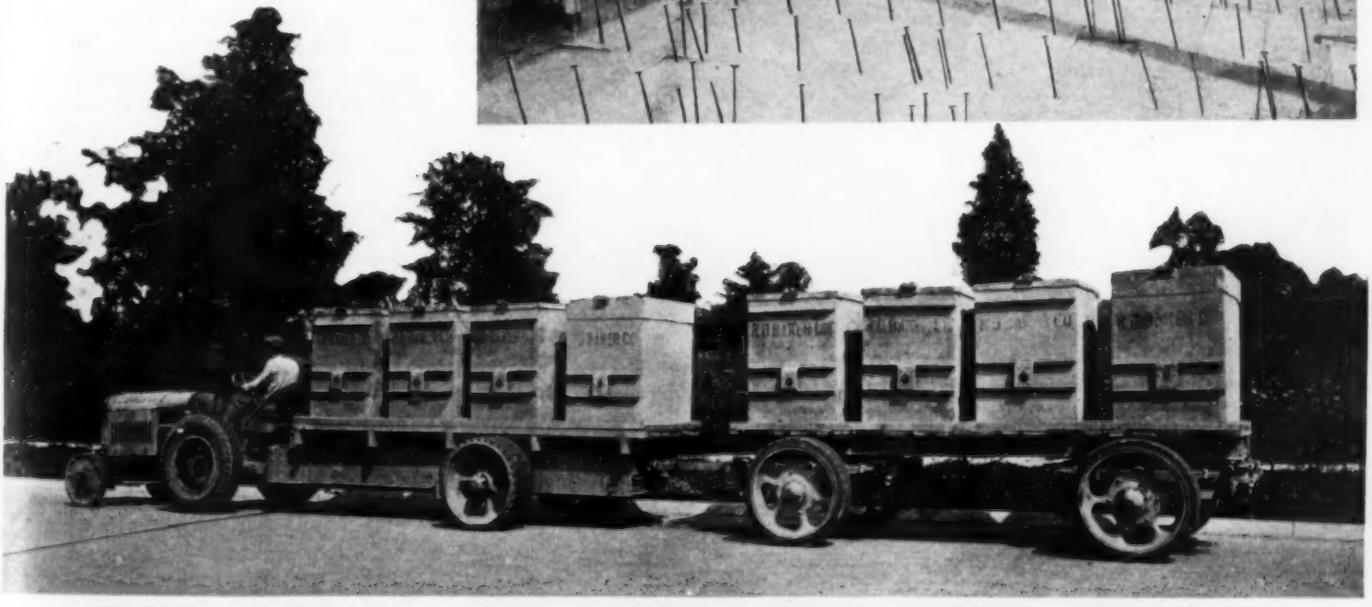


RAILROAD CROSSING of old 50-lb. rails built by Chicago & Northwestern Railway Co. at intersection with Wisconsin concrete road. Block is placed on top of tie to bring lighter rails to same level as running rail. Rails are laid base to base, with notches in bases to take spikes. Flange rail, in horizontal position, with base cropped to fit running rail, braces lighter rails against main-line rail. Crossing has exceptionally smooth riding surface.

Photograph from
C. ENGELBRETH
Wisconsin Highway Department

TWO PNEUMATIC HAMMERS (*below*), operated by Schramm compressor, drive 1,408 spikes an hour for Scherer & Carlson on Port of Seattle docks.

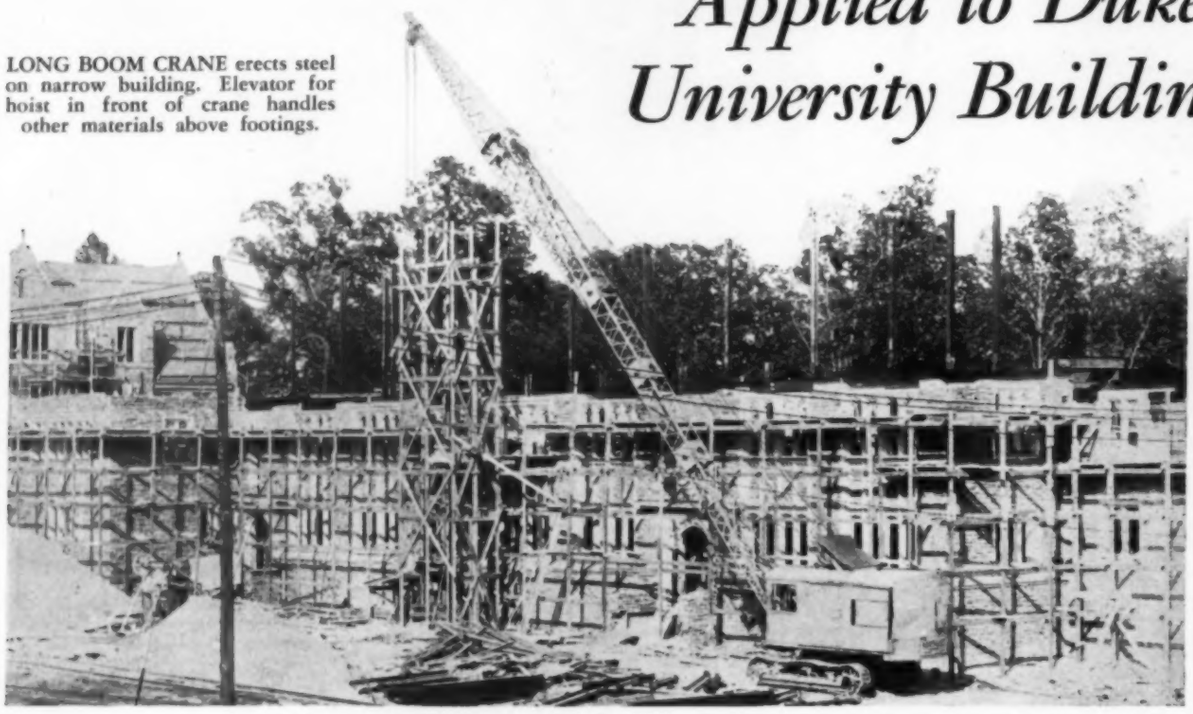




TRACTORS AND TRAILERS serve concrete paving operations around Detroit. R. D. Baker Co., of Royal Oak, Mich., is using 22 McCormick-Deering industrial tractors, each equipped with semi-trailer and trailer, to haul batch boxes, gravel and industrial railway track.

MASS PRODUCTION METHODS

Applied to Duke University Buildings



LONG BOOM CRANE erects steel on narrow building. Elevator for hoist in front of crane handles other materials above footings.

METHODS and equipment ordinarily employed on heavy construction projects have been used effectively by the Duke Construction Co. in carrying out the $20,000,000 building and improvement program of Duke University at Durham, N. C. Customary procedure in erecting buildings of the high type involved also has largely been set aside in favor of mass production methods. Volume schemes of handling materials with large equipment units likewise has been found to give low costs and to permit of fast work.

Duke University, when completed, will consist of two groups of buildings, one at the original location in Durham and the other at a 3,600-acre site outside the city. At the original location, the buildings existing at the time the university received an immense endowment from the late J. B. Duke have been supplemented by several modern structures, making a complete college unit for young women. On the 3,600-acre site there has been erected a group of entirely new fireproof buildings of the highest type. It has been on this new group that heavy construction plant and mass production methods have proved effective.

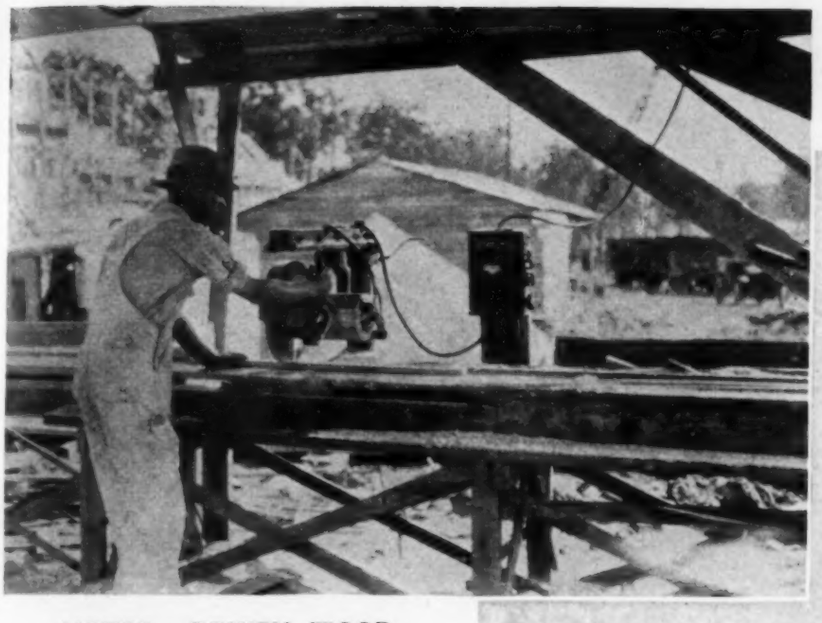
STANDARD-GAGE TRACK LAYOUT at one end of quadrangle. Ample track room permits cars to be spotted where materials are needed.

The new group occupies a site around a quadrangle about 1,600 ft. long by 200 ft. wide. The buildings are, in the main, two- and three-story structures having stone masonry walls on concrete footings and with structural-steel roof construction covered with tile. At one end of the quadrangle is a medical school and hospital group forming the largest unit of the plan. A tall chapel tower midway on one side presented a variation of the construction problem.

A permanent railroad siding to provide facilities for the power house of the group was extended lengthwise of the quadrangle for construction service. To permit work to proceed on the large medical school and hospital group the track was placed at the ground floor level through this group. The steel frame of the latter was then erected around and over the track. Work on the group was thus carried right ahead without hindering operations on the switch track over which all the materials for the project were delivered to place.

In laying out rail sidings the full length of the quadrangle, provision was made for a through line with ample storage tracks at convenient points. The plan of operations involved the use of large crawler-mounted cranes to unload sand and stone for concrete, handle structural steel and other materials.

Sand and crushed stone obtained



MOTOR - DRIVEN WOOD WORKING SAW, in temporary setup, is typical of auxiliary equipment used.

FOR HANDLING MATERIALS the construction equipment included a long-boom crawler crane for unloading structural steel and a guy derrick for erecting university structures.

from adjacent commercial producers were delivered in open top cars. The latter were unloaded by the cranes into large stock piles placed according to the needs along the quadrangle. A cement storage shed was located close to each pair of stock piles. This scheme avoided practically all rehandling of concrete materials after they were delivered.

On account of the limited volume of concrete at any one point in the project and the considerable total yardage, movable batching and mixing plants were adopted. These plants were set up at strategic points along the sidings where they could be served readily by one of the big cranes. When the area easily reached from a setup was finished they were moved to the next location, the shifts being quickly and cheaply made.

Studies of various methods of moving concrete from the mixing plant to place in the buildings led to the adoption of two-wheel buggies operated by hand over substantially laid plank runways. The latter were kept on grades favorable to the loaded buggies. They extended to and over the forms for the building footings. Concrete for the superstructures was delivered in the buggies to motor-driven material hoists operating in towers set up outside the walls.

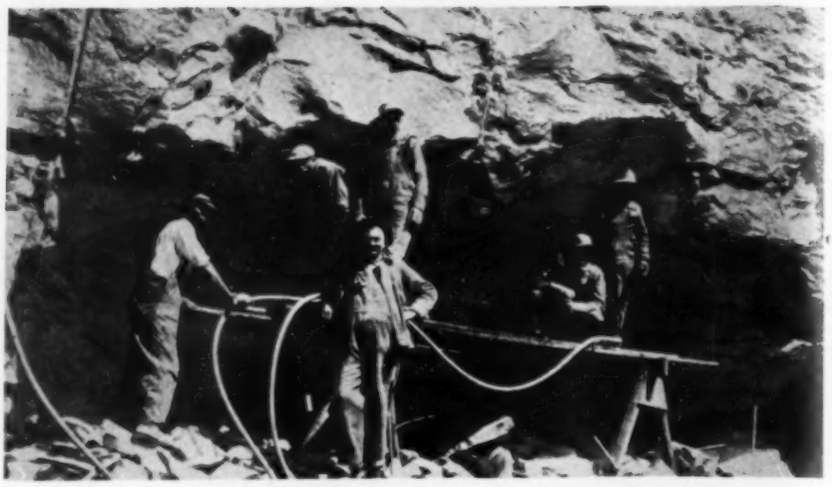
This method of handling concrete permitted work to be pushed on several buildings at the same time. Where limited quantities were needed beyond the range of the central mixing plant, or after the latter had been shifted, motor-driven portable 7-ft. mixers were used. These were supplied with materials by hand from adjacent stock piles. Their output also was wheeled to place in buggies operating over plank runways.

To provide the large volume of stone needed for the rubble masonry walls of the buildings, the contractor opened a quarry a few miles from the site. Deliveries of this stone were made by rail and unloaded by the large cranes, which were shifted so as to spot the stone almost exactly where needed. The extensive quantities of roofing tile and Indiana limestone required were similarly handled.

Motor-driven portable equipment units were used wherever they might save time or money. For example, practically all of the sawing and shaping of construction lumber on the job was done with small units that were shifted from one temporary setup to the next. These units were of high-type permanent wood-shop character rather than the ordinary light portable rigs.

A. C. Lee, chief engineer of the Duke Construction Co. has had entire charge of the project.

By VINCENT B. SMITH
Assistant Editor,
Construction Methods



STARTING SECOND ROUND, after turning under heading at south portal of Summit tunnel. Drillers first sink heading holes.

Railroad Construction

Builders Perform Difficult Grading, 38 Miles of Relocated Branch

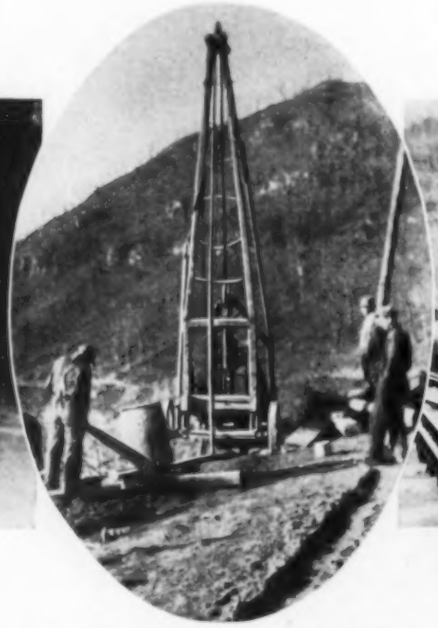
CONSTRUCTION of the 26.5 miles of standard-gage Big Sandy & Cumberland Railroad from Hurley, Va., to Grundy, Va., and to the Virginia-Kentucky state line, involves the excavation of more than 2,000,000 yd. of material, mostly solid rock, and the driving of a 3,750-ft. tunnel. The new line, which has a total length of more than 38 miles, replaces an existing narrow-gage line owned and operated by the Big Sandy & Cumberland Railroad. This narrow-gage line connects with the main line of the Norfolk & Western Railway at Devon, W. Va.

Last month's *Construction Methods* described the work on the 12 miles of Big Sandy & Cumberland main line between the Norfolk & Western main line and Hurley. This article discusses the remaining 26½ miles of the project. As indicated by the map, *Construction Methods*, August, 1930, p. 45, 14 miles of this portion, from Hurley to the Levisa River, is new location. From Hurley, the line ascends Lester Fork for 7 miles on a 1.85 per cent compensated grade to the Summit tunnel, whence it drops for another 7 miles down Home Creek on a grade of —1.72 per cent, compensated, to the Levisa River.

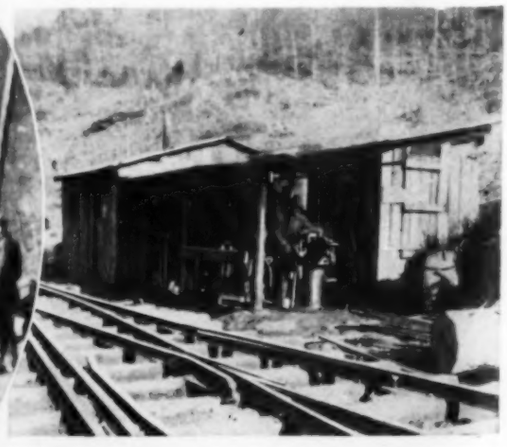
Contractors—From Hurley to a point on Home Creek 1 mile south of the tunnel, the Walton Construction Co. of Roanoke, Va., is the contractor. This concern had all the grading and tunnel work on the 8 miles included in this portion. Contract for the remaining 18½ miles was awarded to the H. W. Nelson Co., New York City. This company sublet the grading on 4 miles to the W. H. Anderson Construction Co., of Ashville, N. C.

Tunnel Construction—The tunnel, as the critical factor in the completion of the project, took precedence over the other items in the program of the Walton Construction Co. Work was carried on from both portals; but conditions and methods at the two ends were in decided contrast. Uniform, hard gray sandstone in the south end permitted excavation of the full tunnel section without timbering. Relatively thin horizontal sandstone strata, interlarded with slate and coal seams, made it necessary to drive a top heading from the north portal and to timber much of the heading.

LOW MINE CAR, with body set down over wheels, is type used in north heading.



WELL DRILLS sink holes for blasting all but very shallow rock cuts.



COMPRESSOR STATION and blacksmith shop supply air and sharpen steel for jackhammer drills along Levisa River.

AFTER SECOND ROUND at south portal, shovel loads blasted rock from heading and bench.

in Mountain Country—V

Bridge and Tunnel Work in Broad-Gaging Line of Norfolk & Western Railway

A complete power plant at the south portal supplied compressed air and electricity for all mechanical operations.

South Portal—Tunnel driving conditions at the south portal were favorable from the beginning. The contractor was able to take out the full tunnel section for a distance of 2,316 ft. Bad rock encountered at this point made it necessary to discontinue the bench and to drive the top heading only for 116 ft. to meet the heading from the north.

F. W. Clark, superintendent, drilled and shot the full tunnel face at one time, using a top heading and two benches. To avoid interference of the drilling and mucking operations, only vertical holes were drilled in the benches.

The contractor's plan of drilling and shooting employed a greater number of holes and a smaller quantity of explosives than otherwise would have been necessary to pull the face. This method of shooting broke the hard rock in pieces small enough to pass through a ¾-yd. dipper.

The crew drilled 32 holes in the heading, using a V cut to pull the center. In the top holes, the drillers used 10-ft. steel; 12-ft. holes were bored at the sides of the heading in an effort to square up the face. Delay exploders were placed in all holes except the cut holes, which were shot direct. Four No. 8 delays were used in the roof holes; four No. 6's, in the next ring; and No. 2's, in the ring adjoining the cut holes.

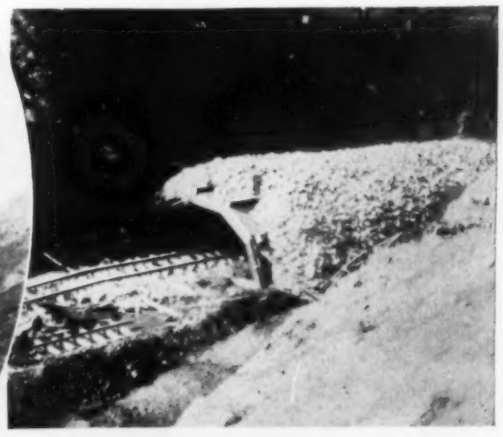
In uniform rock, the same number of vertical holes was drilled in each bench—an average of about twenty for each lift. The twenty holes were put down in two rows across the width of the tunnel. Mr. Clark shot the center holes direct, but used delay exploders in the other holes: No. 6's in the holes next to the center, and No. 8's in the end holes of both rows.

Two drifter drills were operated in the heading, and four sinkers were used on the two benches. The contractor had four water-jet drifters, all of which saw service in the heading; three Ingersoll-Rand N-75's and one Chicago Pneumatic 6. Three Ingersoll-Rand X-59 sinkers and one Chicago Pneumatic 5 sinker put down the bench holes. The X-59's are water-jet drills; but the contractor used them dry.

The total of 72 holes was loaded with 9 cases of duPont 60 per cent gelatine dynamite. Each round ad-

TIPPLE at north portal dumps heading muck from low 3-yd. mine cars into 6-yd. cars. Crib wall holds mud bank.

DIESEL SHOVEL and tractor trucks comprise material-moving unit on Home Creek section.



CONSTRUCTION TUNNEL, 87½ ft. long, protects north portal from slides. Timber rings are set tight, sheathed with lagging, covered to depth of 4 ft. with one-man stone, and backfilled with mud from slopes above.

W. E. HANKINS, resident engineer, Norfolk & Western Railway Co.

WILL FAULCONER, general manager, Walton Construction Co.

S. S. WARD, resident engineer, Norfolk & Western Railway Co.

vanced the face an average distance of 7½ ft.

An air-operated ¾-yd. Erie Steam shovel loaded the broken rock into 6-yd. Koppel cars. Eight of these cars hauled rock from the shovel. A G. E. 12-ton electric trolley locomotive, with 600-ft. cable reel, pulled three-car trains to the portal.

Progress—Each of two 10-hour shifts per day drilled, shot and mucked one round.

North Portal—Difficulties at the north portal began with the approach cut. The heavy overburden consisted of a blue clay which became fluid when wet. This formation caused a number of serious slides. To protect the north portal from these slides, the contractor built a construction tunnel 87½ ft. beyond the rock portal. Bad rock compelled the contractor to resort to the top heading method and to timber the heading for 322 ft. from this portal. Two BCR-430 Ingersoll-Rand jackhammer drills were used to advance the face.

Muck in the north heading was loaded by hand into low 3-yd. mine cars. Mules hauled these cars to the portal where the rock was dumped from a tipple into 6-yd. Koppel cars, which were pulled to the dump by steam dinkeys.

Tunnel Ventilation — Robinson 24x5-in. centrifugal fans at both portals forced fresh air to the faces through lines of duPont Ventube, a 20-in. tube being used at the south end and a 12-in. tube at the north.

NORTH APPROACH CUT to tunnel, requiring excavation of 87,000 yd. of blue mud and 28,000 yd. of rock, is made by 2-yd. steam shovel.

Walton Construction Co. Grading Work—Grading work on the Walton Construction Co.'s 8-mile contract section was heavy, averaging about 100,000 yd. to the mile. One of the most difficult parts of the outside grading was in the approach cut to the north portal.

This 115,000 yd. cut was made in three lifts by a Marion 480 2-yd. steam shovel, which loaded trains of 4- and 5-yd. Western dump cars. Two 20-ton steam dinkeys, a Porter and a Vulcan, hauled these trains about 3,000 ft.

Excavation on the 7 miles from Hurley to the tunnel totaled more than 700,000 yd. Berms of all cuts were removed to provide additional material for the fills. Cuts ranged up to 100,000 yds. in quantity and up to 85 ft. in height to top of slope. The largest fill contained 176,000 yd. and was 54 ft. high. Material on this section was approximately 85 per cent solid rock.

The Walton Construction Co. used three 5-in. Winchester well drills on all the deep cuts. M. W. Martin, superintendent of all grading work on Lester Fork for this company, had three shovels and a quantity of narrow-gage railway equipment to handle his spoil. The three shovels worked at separate locations. Narrow-gage equipment was used in conjunction with the two larger shovels.

To take an average day as an example, on February 12, 1930, the Marion 480 2-yd. shovel was working in a 50,000-yd. soft sandstone cut near the upper end of the section. Two trains of 10 4-yd. Western cars each, drawn by two 20-ton Vulcan steam dinkeys,

served this shovel. A Marion 37 1¼-yd. steam shovel was operating in a 48,000-yd. cut, of solid slate, several miles farther north. Spoil from this shovel was hauled by four trains comprising a total of 36 Western 4-yd. cars. The smallest shovel, a 1½-yd. Osgood, was casting material at Hurley, where about 12,000 yd. was to be moved in this way. This shovel later was used for dressing the grade.

H. W. Nelson Co. Grading Work—On its 6-mile grading section along Home Creek, excavation on which amounts to 160,000 yd. of solid rock and 245,000 yd. of other material, the H. W. Nelson Co. used one diesel shovel, one gasoline shovel, tractor trucks, and narrow-gage railway equipment. Practically all the work was side-hill. Very little material could be cast.

Five cuts on the Home Creek section were drilled with a Cyclone 5-in. well drill.

The narrow-gage railway equipment, consisting of two Milwaukee 10-ton gasoline dinkeys and twelve 5-yd. Western cars, worked in conjunction with the Northwest gasoline 1¼-yd. shovel. The longest haul for the dinkeys was 2,800 ft., average haul was 1,000 ft.

Five Linn 7-yd. tractor trucks hauled the spoil from the Bucyrus 50-B 1¼-yd. diesel shovel. These trucks had an average haul of 600 ft.; their maximum haul was 2,200 ft.

Along the Levisa River, the new line follows the right-of-way of the old narrow-gage railroad, which had to be kept in operation during the construction of the new grade.

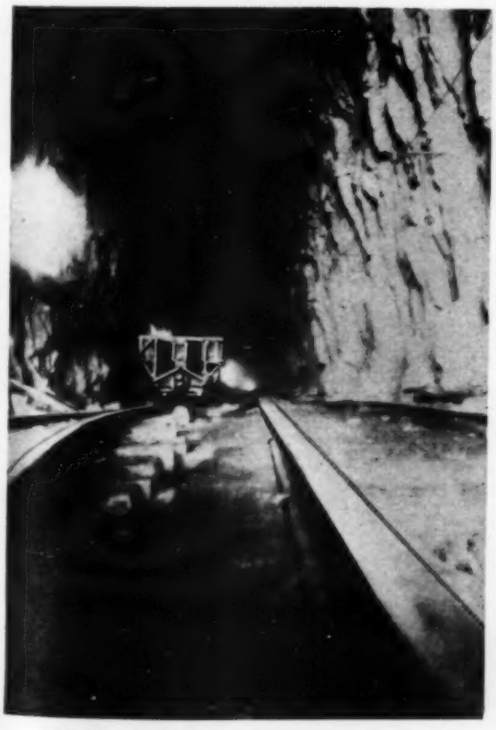
Excavation on the 9½ miles between Grundy and Home Creek, amounted more than 600,000 yd., of which about 55 per cent was solid rock. The largest side-hill cut, about 80 ft. high on the cut line, provided 130,000 yd. of rock. One heavy through cut on this section contained 70,000 yd., of which 85 per cent was solid rock.

In all, the contractor used five well drills on this section, four Sanderson Cyclone machines with 5-in. bits, and one Loomis Machine Co. Clipper drill with a 6-in. bit. The well drills put down the holes for blasting in practically all cuts more than 15 ft. deep.

Two Bucyrus 50-B 1¼-yd. diesel shovels excavated all the material between Home Creek and Grundy. Six gasoline dinkeys, four 12-ton Whitcombs and two 10-ton Milwaukees, hauled the spoil in 5-yd. Western cars. The section was equipped with a total of 30 of these cars; 6 cars usually made up one train.

GASOLINE SHOVEL loads narrow-gage cars, handled by gasoline dinkeys, along Home Creek.

M. W. MARTIN and F. W. CLARK *(left and center)*, superintendents, Walton Construction Co., and W. A. NEFF, resident engineer, Norfolk & Western Railway Co.



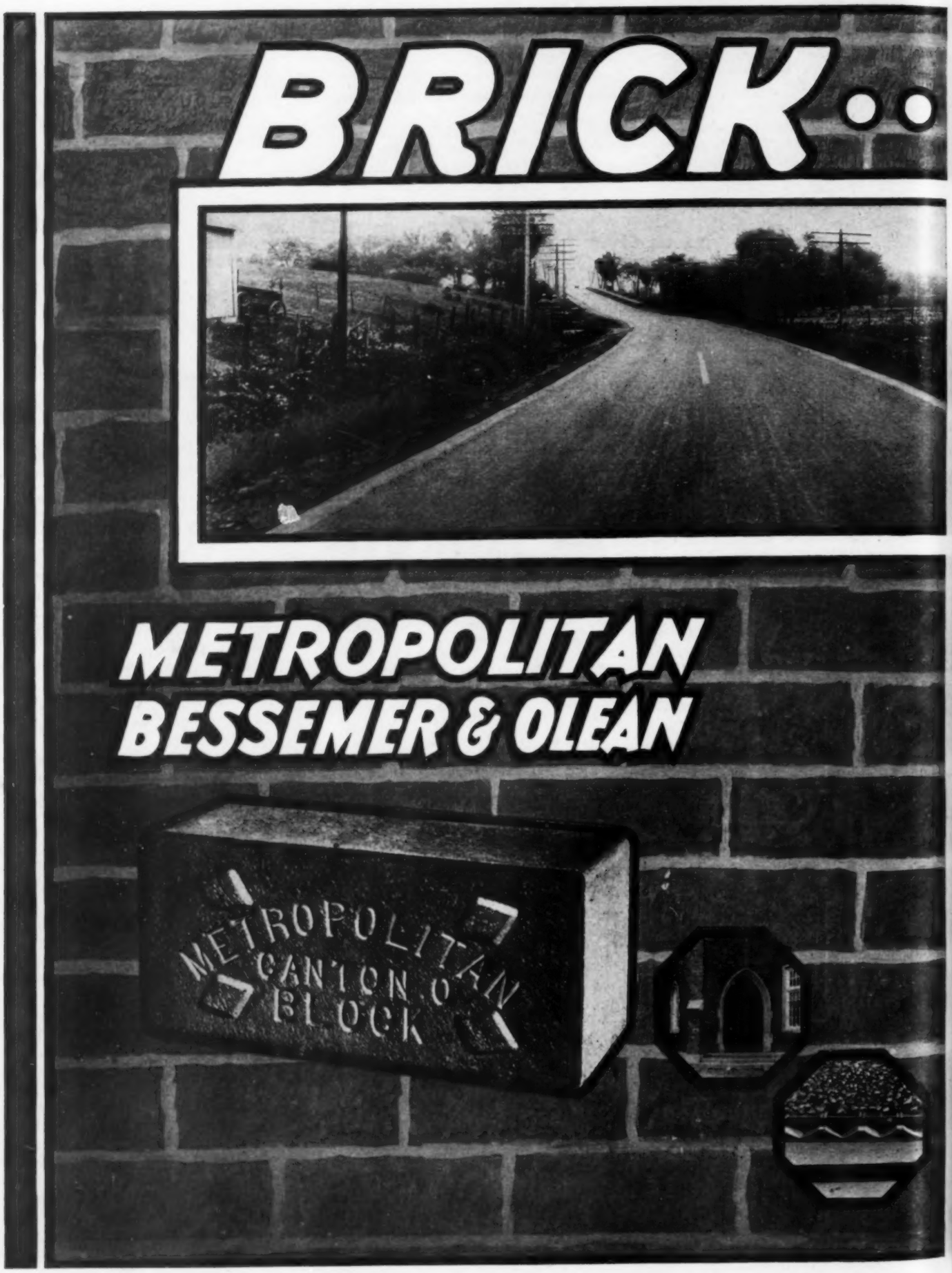
FULL TUNNEL SECTION is excavated for 2,316 ft. from south portal.

W. H. Anderson Construction Co. Grading Work—To move the 140,000 yd. of material, 65 per cent of which was solid rock, on the 4 miles between Home Creek and the Virginia-Kentucky state line, the W. H. Anderson Construction Co. used much of the same equipment which it employed on its sub-contract section on Knox Creek. All the grading on this section was sidehill work.

Supervision—Construction of the Big Sandy & Cumberland Railroad is under the control of W. P. Wiltsee, chief engineer, Norfolk & Western Railway Co., Roanoke, Va. J. W. Raitt, assistant engineer, Bluefield, W. Va., is in more immediate charge of the work.

Five resident engineers have been actively engaged in supervising operations on the portion of the line described in this article; three of these men are now in charge of this work. S. S. Ward has, as part of his residency, approximately 6 miles from Hurley up Lester Fork. C. W. Fiery, until October 15, 1929, had charge of the Summit tunnel and of 3 miles of adjoining open grade work. On October 15, by an exchange of residencies, Mr. Fiery was assigned to the construction of the Guyandot & Tug River Railroad, and W. A. Neff took charge of this residency. W. E. Hankins is in charge of all work on Home Creek below Mr. Neff's residency, and of the 4 miles from Home Creek to the state line. Since February 1, 1930, Mr. Hankins also has had charge of the 9½ miles from Home Creek to Grundy. Up to this date, J. R. Altizer supervised work on the last-named section.

In general charge for the contractors are Will Faulconer, general manager, Walton Construction Co., Richard N. Samson, vice-president, H. W. Nelson Co., and W. H. Anderson, president, W. H. Anderson Construction Co.


BRICK..
METROPOLITAN
BESSEMER & OLEAN
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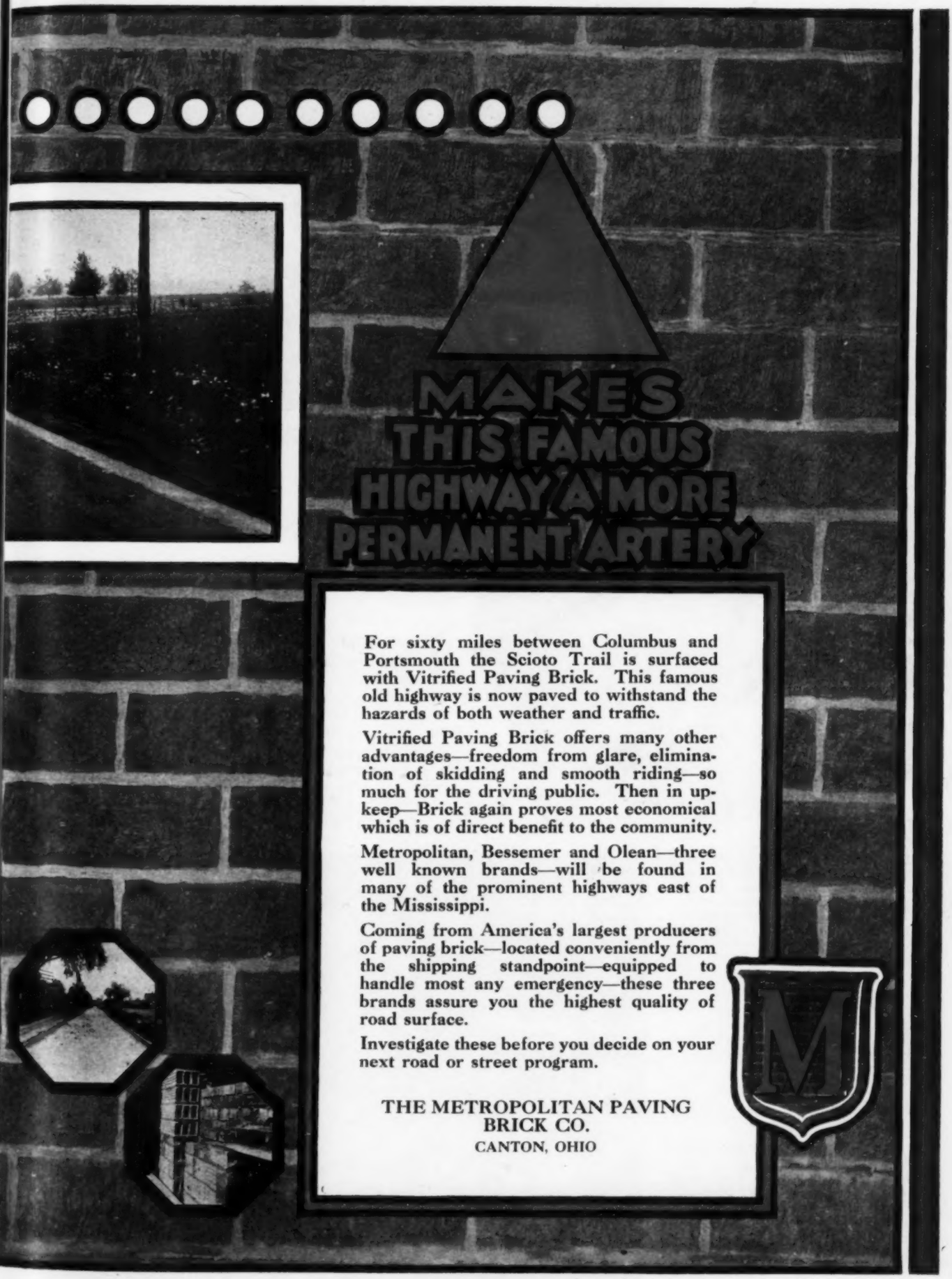
BLOCK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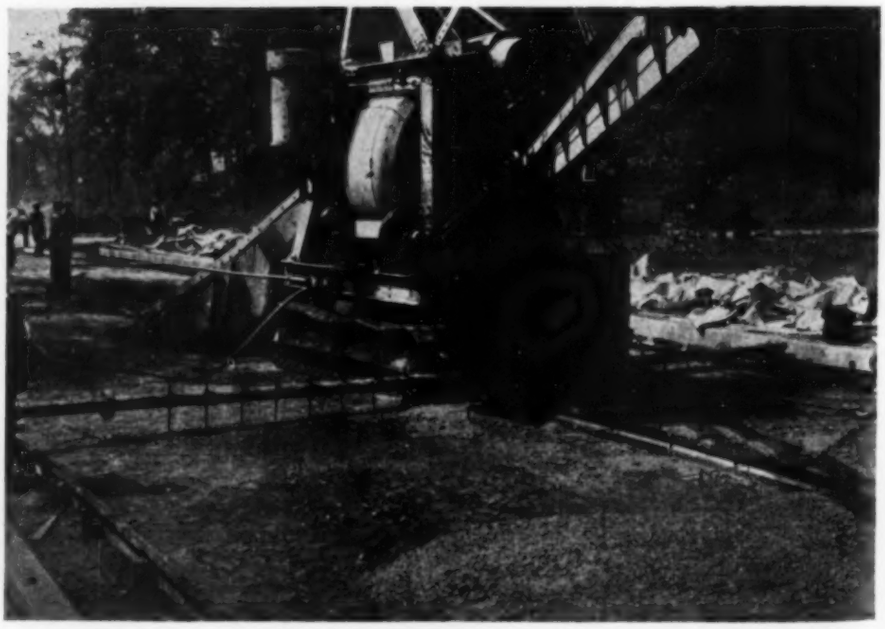
1 STEEL ROAD FORM is set as track for finishing machine, its distance from curb depending upon width of street and finisher. In this instance form is placed 2 ft. from curb.

Step-by-Step
Concrete Street Paving

INDIANAPOLIS requires that the center strip of all concrete street pavements be struck off and consolidated by a finishing machine. The strip between the machine-finished slab and the curb is placed and finished later by hand. As indicated in the accompanying illustrations, some new and interesting construction methods have been developed in applying the mechanical finisher to city streets.

The street pictured is 30 ft. wide between curbs.

2 DEFORMED METAL PLATE (*above*) is bolted or welded to inside face of forms to make a groove in edge of center slab. This groove forms a keyway which is filled when side strips are placed, preventing unevenness at joint.



3 ELEVATION OF SUBGRADE (*right*) is checked by scratch template resting on side forms and drawn forward as mixer advances. Teeth make scratches in any high spots which are then removed with shovels.

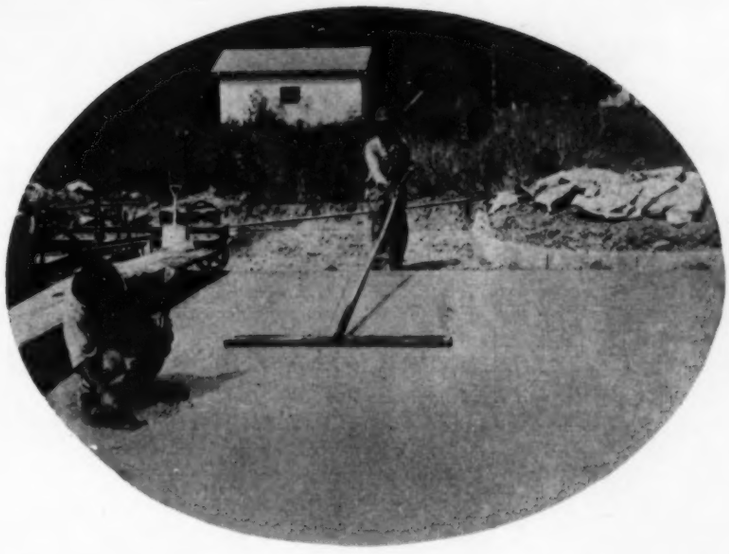
4 26-FT. CENTER STRIP (*left*) is divided longitudinally into slabs 13 ft. wide by deformed metal plate held in place on subgrade by stakes. Plate does not run through expansion joints.

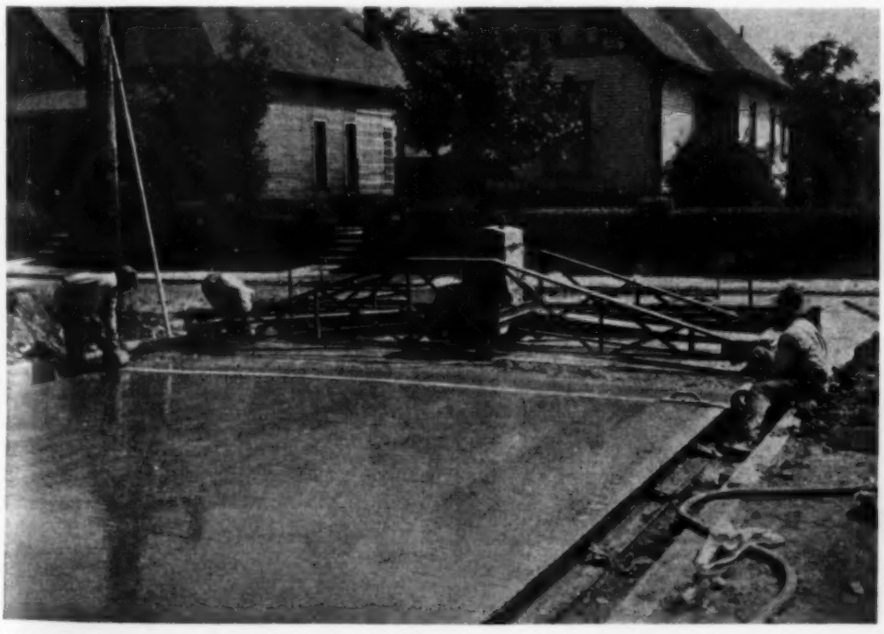
Field Methods

Finished by Machine

The machine finished slab is 26 ft. wide, leaving a 2-ft. strip along each edge, between slab and curb, to be completed by hand. This strip looks much like the gutter apron that is commonly found on paved streets.

The specifications also require that the 1:2:3½ concrete develop a compressive strength of 3,500 lb. per square inch in 28 days and provide for reduced payment for strengths below that amount.





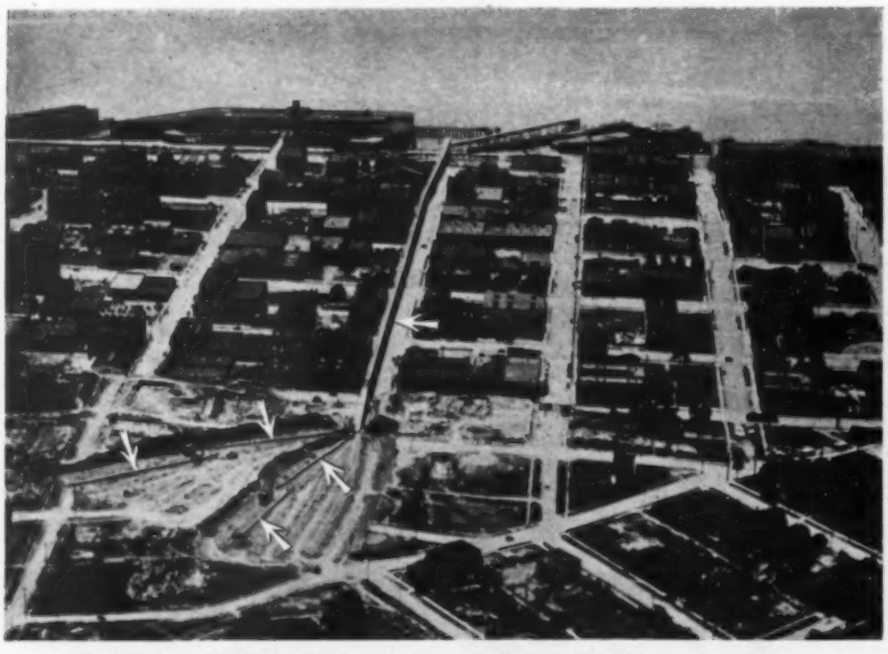
5 SURFACE (*above*) is carefully straight-edged and any inequalities discovered are removed by hand. Disturbed places are smoothed with long-handled float.

6 FINISHING MACHINE (*left*) completes its work and surface is further finished by rubbing it with a fabric belt operated with sawing motion.

MOVABLE BELT CONVEYORS carry excavated material from first cut of project, along Fifth Avenue. Shovels feed hoppers over belts. Note junction of two belt sections in foreground.

Moving a Mountain to the Sea

Belt Conveyors Carry Top of Seattle's Denny Hill to Barges in Puget Sound



RADIATING FROM CENTRAL LOADING POINT, movable conveyors on two levels carry excavated material to main conveyor in long covered structure. Arrows indicate movable and fixed conveyors.

A HALF-MILE of electrically-driven belt conveyors has moved 4,223,000 yd. of material from Denny Hill, Seattle, Wash., since Sept. 14, 1928. On that date, George Nelson & Co. of Seattle were awarded a general contract for the regrading of the hill at a price of 25c. per cubic yard. Excavation was sublet by the general contractors to Copenhagen Brothers, Portland, Ore., and to the Nevada Contracting Co., Fallon, Nev.

General Plan of Operations—George Nelson & Co. adopted belt conveyors as the best method of handling the material, and the Link-Belt Co. designed and furnished the equipment. The conveyors moved the material from the point of excavation to the waterfront, delivering it to barges that dumped in deep water in Puget Sound. A loading point for the main conveyor belt was located centrally with respect to the total yardage to be moved from the regrade area of 32 city blocks. Movable conveyor units, mounted on skids, fed the fixed conveyor at this point. All excavating was done by electric shovels. From the central loading station to the waterfront, an elevated timber structure was built to house the main conveyor, practically eliminating all interference with street traffic.

The line of movable conveyors and

the power shovels serving them rotated around the central point where delivery to the permanently located conveyor belt was made. At the start, the movable conveyor units were stretched out along Fifth Avenue to the south of the main conveyor belt. The line of conveyors along Fifth Ave. and the operations in bench cuts at higher levels swung gradually east as the work progressed and ultimately around to the north. The bench cuts at higher levels were made by the same methods used at street level and delivered to the same point on the main conveyor system, the bench operations merely adding more faces along which the work might be advanced.

The material ranged from wet sand to hardpan containing considerable blue clay. Some boulders were encountered which were removed by a separate crew as soon as they were unearthed. Specifications for delivery to the main belt required the material to pass through a grillage in which the bars were spaced 12 in. apart.

Excavating Equipment—Excavation was carried on both along the working face at street level, which at the outset extended along Fifth Ave. to the south of the main belt, and also at benches cut at higher levels. Four shovels with 2-cu.yd. dippers and two with 1½-cu.yd. dippers were used. Dippers discharged into receiving hoppers mounted on double-flanged wheels which ran on timbers laid on the skids extending from under the belt conveyors. At the outset, timber hoppers were used, steel hoppers being substituted later. Over the receiving hoppers were 1¼x8-in. steel bars, set on edge, 12 in. apart, to prevent large boulders from getting through to the belt. (These bars were put in after railroad rails had been found to be too light.) Each hopper was equipped with a 5-hp. motor connected by chain drive to a steel apron feeder. Operation of the feeder is regulated so that delivery from each hopper to the belt will be limited with respect to the other units serving the same belt, thus avoiding overloading of the main belt.

The movable belt sections were each 250 ft. long and were interchangeable units in all respects. Motive power for each section was supplied by a 20-hp. motor. At each junction point between the 250-ft. units, the delivery end of the belt was elevated to drop material on to the next succeeding unit. At these junction points, sideboards lined with steel plates were built up to prevent spilling. No difficulty was experienced in operating with the conveyors on an angle at the junction point. Thus the units could be moved as often as was desirable to keep the belts in the most effective location. The belt capacity in both fixed and movable systems was the same, ranging from 500 to 600 cu.yd. per hour, according to the loading. Belts mounted on skids were 30 in. wide and all others were 36 in. wide. The movable belt sections operated at a speed of 400 ft. per minute, and the fixed belt speeds were 600 ft. per minute.

Main Conveyor System—For approximately a half mile the main or fixed belt system was carried in an

ELECTRIC SHOVEL ***(above)*** **feeds movable hopper rolling on timbers laid parallel to belt conveyor. Grizzly refuses boulders more than 12 in. in size.**

WORKING AT SEVERAL FACES ***(right)*** **on different levels, shovels keep feeder conveyors loading main conveyor at rate of 500 to 600 yd. an hour.**

elevated timber structure with a clearance of 18 ft. above street level. Over eight street crossings on the route, the elevated structure was carried on timber trusses, the maximum span being 72 ft. Ample space was provided within the elevated housing to give access to both sides of the belt, with a 3-ft. walkway on either side. On both sides of the housing, 2-in. planking was carried up above belt level to reduce risk to persons and property below from fragments that might be dislodged from the belt. As the prevailing winds in the summertime are from the southwest, the south side of the housing was entirely boarded up to prevent dust nuisance.

From the central loading point, the main belt line traveled up an incline to reach the height needed for street clearance. This first section of the main belt system was 943 ft. long. It was operated by a 100-hp. motor, which gave a capacity 33 per cent greater than the maximum load to take care of any momentary overloads that might occur.

At the outset, the transfer of material in the elevated structure was accomplished by dropping it through the usual steel-lined chute, using a rubber belt lining to muffle the noise because the transfer point was in a residential district. Later, when wet material was being handled, the arrangement was changed to provide for dropping material from one belt directly on to the other.

The next section of the main belt was 1,455 ft. long and was operated (also with 33 per cent excess capacity) by a 50-hp. motor. The smaller motor was suitable because this section had no lift. On the contrary, its lower portion was on a downgrade. When this belt was fully loaded, its motor tended to operate as a generator and really functioned as a brake. A solenoid brake was provided on this motor to stop and hold the belt in case it became necessary to shut down while only the inclined portion of the belt was loaded. This feature was also a safety measure to hold the belt if the power should suddenly fail while the

MAIN CONVEYOR is carried in elevated timber structure which practically eliminates interference with traffic. CONVEYOR HOUSING (*above*) is boarded up on side of prevailing winds to prevent dust nuisance. Belt rolls have roller bearings easily accessible for repairs and greasing.

belt was loaded. In both these long sections of the main belt, compensation for slack is made by a counterweighted automatic take-up hung in a vertical position with a travel of 15 to 30 ft. designed to maintain at all times a uniform tension on the belts.

Electrical Control—From the end of the 1,455 ft. conveyor to the point of discharge on the pier, a 400-ft. length of belt was operated by a 30-hp. motor. From the discharge end of this belt, the material fell into a chute leading directly to barges floating alongside the pier. Electrical control for the various motors operating the belts was worked out so that, when any belt in the system was stopped, all belts behind the one stopped by the operator automatically stopped at once. For example, if the belt at the waterfront was stopped by the operator at that point, all belts stopped immediately (including those in the movable belt sections). They were restarted in sequence by a signal system beginning with the belt nearest the discharge end. This arrangement avoided any danger of overloading.

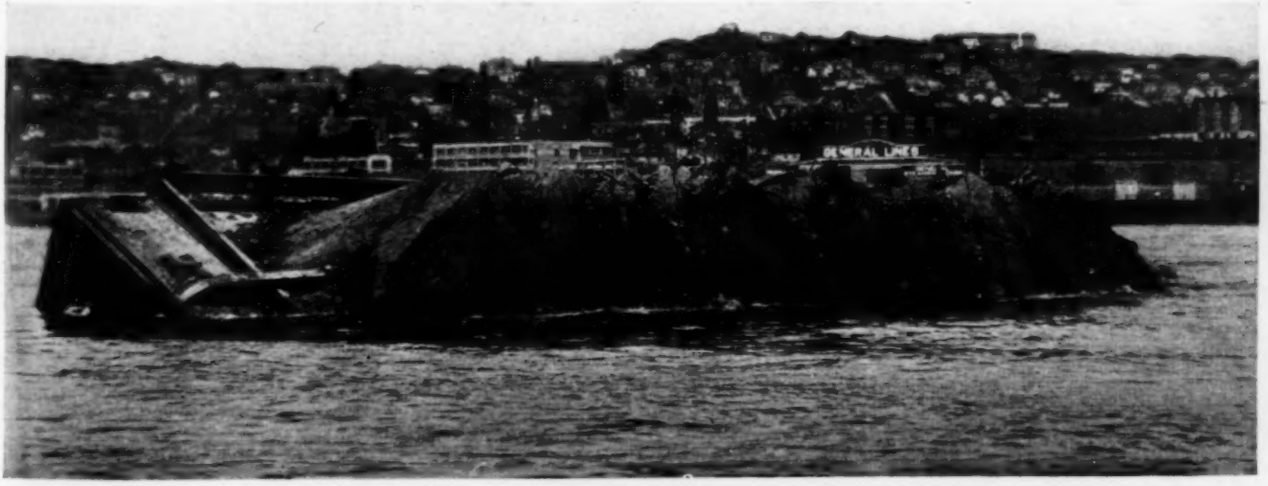
In the long fixed belt section driven by the 100-hp. motor, wear on the belt fabric due to the drive mechanism has been reduced by a "hugger drive" or pressure belt. This auxiliary belt presses the main conveyor belt against the drive pulley so as to ease the initial tension upon it.

The slope of the harbor bottom along Seattle's waterfront is steep, and deep water could be reached by very short hauls from the pier. The contractors were free to dump barges at any point within prescribed limits outside the pier headlines with the proviso that the bottom would not at any point be brought above a depth, at low tide, of 64 ft.

BARGES receive material as it falls through chute from end of last section of main conveyor.

Self-Dumping Barges—The barges were of the automatic dumping type, and were built of wood, with a deck size of 100x34 ft. overall and a 9½-ft. center depth. They were designed to carry 400 cu.yd. of material on the estimate that the spoil would weigh approximately 3,000 lb. per cubic yard. The sea cocks opening into the eccentric tanks which provided the unbalanced loading for overturning were of such size that, when the inlets were opened on a loaded barge, only 3 min. was required for the tanks to take in enough water to cause overturning. Freed of its load of earth, the overturned barge rose to a height such that the water in the eccentric tanks drained out by gravity in a period of 8 min. The barge was then ready for loading on the newly upturned side, and this load was later dumped by another overturning accomplished in a similar manner, as illustrated in the accompanying photograph.

The Denny Hill project is under the direction of W. D. Barkhuff, city engineer.



AUTOMATIC DUMPING BARGES are overturned by admitting water to eccentric tanks. When overturned and dumped, the barge rides high enough to drain the tanks by gravity. It then is ready to take a load on the newly upturned side.

Tenth of a series of articles on the $325,000,000 construction program for flood control in the Mississippi Valley

The Defense Against OLD MAN RIVER-X

By ROBERT K. TOMLIN
Editor of *Construction Methods*

Fascine Mattress Revetment

IN ADDITION to the two forms of concrete revetment previously described in this series of articles (see *Construction Methods* for March and July, 1930) the Corps of Engineers, U. S. Army, is placing willow mattresses to protect the banks of the Mississippi River from undercutting currents. Two types of revetment made of willows—the fascine type and the framed mat—are now provided for in the Government's specifications; this article illustrates and describes the fabrication and sinking to place of the fascine type.

The fascine type of revetment consists of long bundles (fascines) of willows wired together and bound with cables to form a large floating mattress which is later sunk by weighting it with stone ballast. The mattress is built at the place where it is to be used and involves a considerable outlay in floating plant and special equipment. While

MOORING BARGES (*left*), at upstream end, act as anchorage for floating willow mat. Note pole cribbing to retain stone ballast with which mat is weighted for sinking to river bottom.

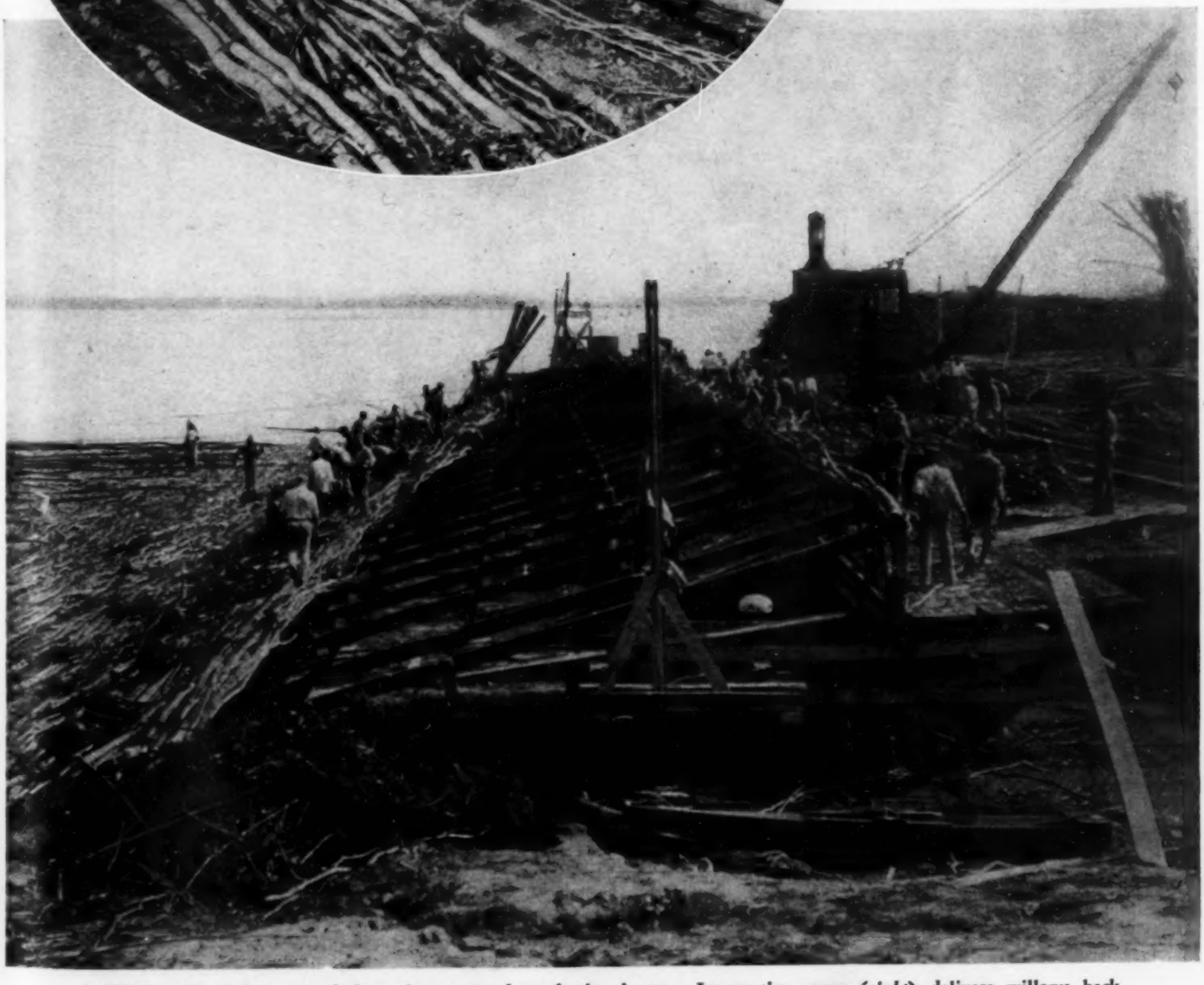
POLE STIFFENERS are wired to fascines and bottom cables to complete fabrication of willow mattress. Fascines are formed of 16-in. diameter bundles of willows wired and laced side by side and extending perpendicular to shore line.

the sizes of individual mattresses vary to suit local conditions an average unit or "channel mat" is from 1,000 to 1,200 ft. long and from 150 to 300 ft. wide. The width is governed by bank conditions, the usual practice being to extend the mat from the water's edge outshore to a point 50 ft. beyond the submerged foot of the bank slope. Between successive mat units an overlap of 15 ft. is specified and the completed revetment, with its load of stone, is permantly anchored by cables extending to deadmen on shore.

Beyond the inshore end of the willow mattress riprap paving is extended up the bank of the river to a point where monolithic concrete paving is laid to protect the upper reaches of the bank during high water stages.

As illustrated in the diagram on p. 60, the major elements of the floating plant required are a pair of mooring barges at the upstream end of the bank section to be protected by revetment, a fascine assembly barge and barges and tow boats for the delivery of willows. In addition, Government quarter boats, with cooking and sleeping accommodations, are supplied for the construction personnel. The fascine barge, where the mat weaving operations are carried on, is fitted with a track and locomotive crane for unloading willows from the brush supply barges and with inclined launching ways having yokes at their upper ends for the assembly of willows into bundles of the proper size. The launching ways, as illustrated in the

WILLOWS (*left*) are assembled and placed by hand in yokes at upper end of barge launching ways.



LAUNCHING WAYS extend down into water from fascine barge. Locomotive crane (*right*) delivers willows back of assembly yokes. Fascines are wired (*left*) and joined to completed portion of mat.

photograph at the bottom of p. 59, are a series of timber frames, spaced 8 ft. apart, extending into the water for the entire length of the fascine barge. In fabricating a willow mattress the fascines are placed side by side with their long dimension perpendicular to the shore line.

Fascines of a length equal to the width of the mattress are formed of straight live willows at least 30 ft. long and having butts from 2 to 6 in. in diameter. The willows must be used not later than 90 days after they are cut. After being assembled in the yokes above the launching ways the willow bundles are released by tripping levers in the yokes and the fascines slide down the ways to the edge of the completed portion of the floating mattress. Here they are compressed and wired into bundles 16 in. in diameter. The "sewing" wire placed around the fascine is composed of three galvanized steel strands twisted to make a cable ¼ in. in diameter. The parallel fascines are then laced to lines of ½-in. galvanized longitudinal cables spaced 8 ft. apart and extending above and below the mattress for its entire length. These top and bottom cables are composed of seven twisted wires. As the mat grows by the addition of successive fascines, the assembly barge is slacked off downstream from the mooring barge. For compressing and tying the willow bundles forming the revetment mattress, there has been designed a special ratchet-operated winch, known as a "come-along" illustrated in the photograph at the top of p. 61. One of these machines is installed over each pair of longitudinal top and bottom cables.

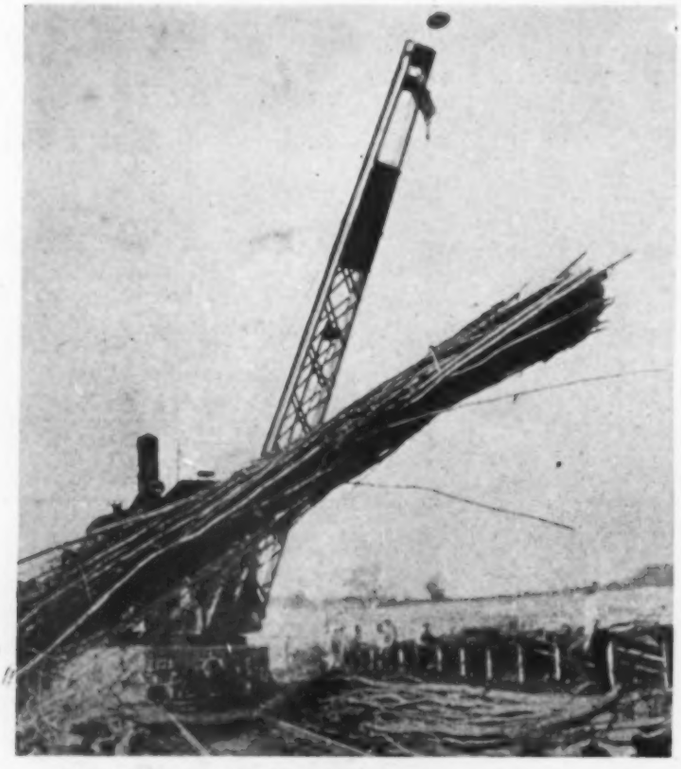
DEADMAN on shore holds cables which anchor mattress at 70-ft. intervals.

The ends of each mattress are formed by fascines of extra large size, a header 3 ft. in diameter at the upstream end and a tail fascine 2 ft. in diameter at the downstream end. To the header are fastened mooring lines which hold the mat in place while it is being fabricated. The U. S. Engineer Department does all of the willow mat revetment by day labor with its own forces and equipment.

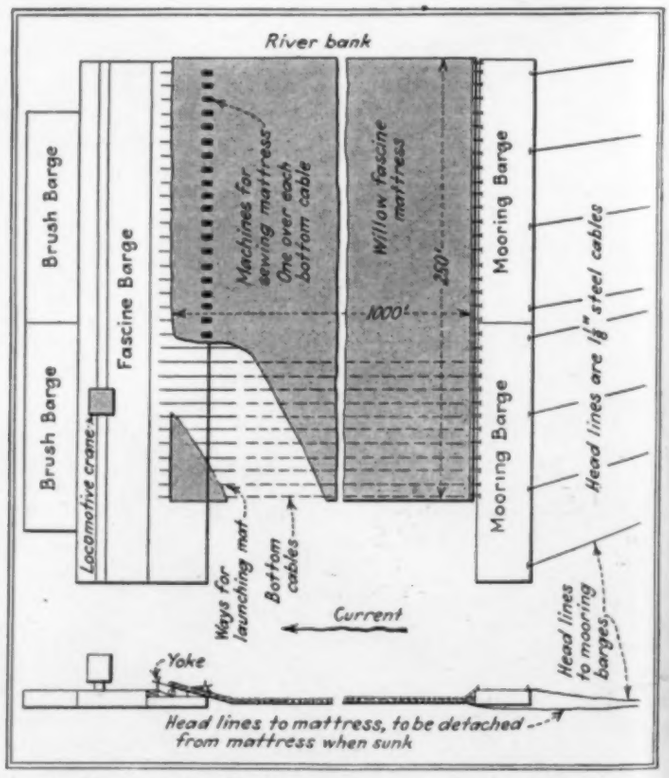
To stiffen and strengthen the flexible mats, willow poles are placed longitudinally and transversely and wired to the fascines and bottom cables. Additional poles are introduced to form cribs 8 ft. square to retain the stone ballast with which the mattress is finally weighted and sunk. These cribs are constructed the entire width of the mattress over the first 90 ft. downstream from the header and for a width of 24 ft. along the other three edges.

Willows are cut at nearby sites, if possible, and delivered by barges to the fascine-weaving plant. They are unloaded by the locomotive crane operating on tracks extending the length of the fascine barge and immediately back of the launching ways. The willows are then sorted, lifted by hand and distributed in the proper amounts in the yokes of the launching ways. The arrangement of the butt and top ends of the willows is such as to effect uniform strength throughout the length of each fascine.

In sinking a mattress, stone from barges moored first along the outshore end of the floating revetment is de-



LOCOMOTIVE CRANE swings load of willows from delivery barge to fascine fabricating barge.



LAYOUT of floating plant, showing method of fabricating fascine type of willow mat.

FOR TYING AND COMPRESSING the willows into fascines (*right*) a ratchet operated winch is used. DETAIL (*above*) shows device for gripping wire.

posited within the crib sections, starting at the downstream end of the section and working shoreward. Plank runways are laid out on the floating mat and the stone pieces are carried out in wheelbarrows and dumped to place. After the head of the mat has been sunk 10 ft. and held at that depth by cables from the mooring barge, the stone barge is floated out over the mat and the ballasting completed, working downstream. The specifications permit the use of stone pieces weighing from

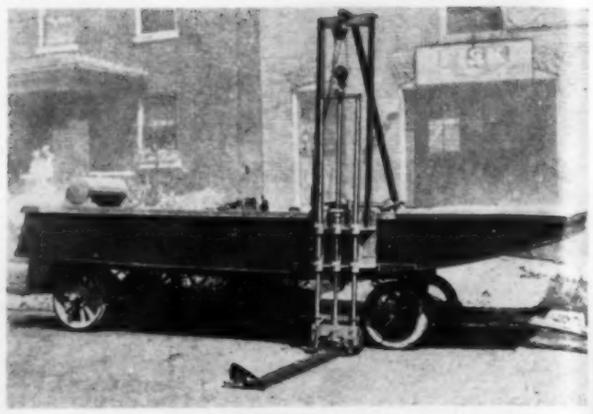
YOKE TRIPS have been released, allowing bundle of willows to slide down the launching ways for wiring up into fascines to be added to completed section of mattress.

10 to 100 lb. Not more than 20 per cent of the ballast may be of stone weighing 25 lb. or less per piece, nor more than 20 per cent of pieces heavier than 75 lb. Not less than 1,600 lb. of stone ballast per "square" (100 sq.ft.) is specified to insure good contact between the mat and the bed of the Mississippi River at all points.

The fascine mattress construction illustrated in this article is at Bullerton Bar, Arkansas, in the Memphis district of the U. S. Engineer Department, Lieut.-Col. F. B. Wilby, district engineer, and Major E. C. Kelton, area engineer, in charge. W. H. Knox is superintendent for the fascine mattress operations, while the bank paving work is under supervision of G. A. Robinson.

NEXT MONTH: Another Mississippi River article describing and illustrating the framed willow mat type of revetment.

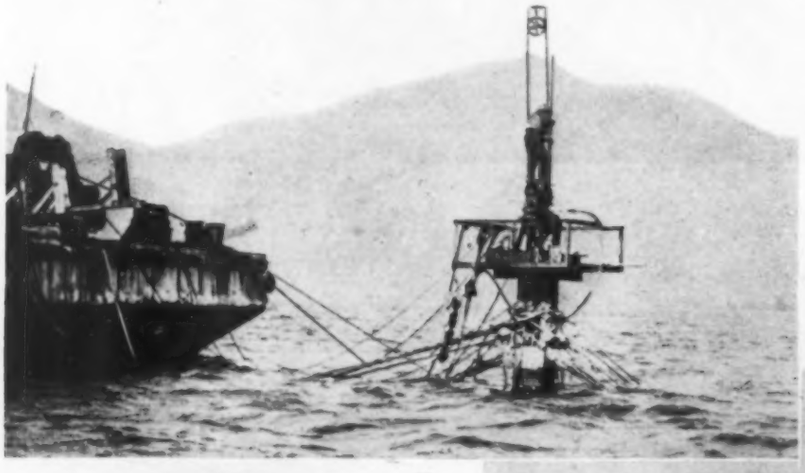
MUSHROOM TANK, known as Hortonspheroid, prevents evaporation losses from volatile liquids. Chicago Bridge & Iron Works builds completely enclosed tank to same shape which flexible container would take if filled with liquid and subjected to given pressure. Relatively low pressure is sufficient to stop evaporation loss from many volatile liquids.



UNDERWATER BLADE attacks lily menace. L. B. Herrington, Jr., of Wilson & Herrington, Louisville, Ky., designed this cutter, adjustable to depths of 18 to 60 in. and driven by motor on flat-bottom scow, to mow heavy growth of pond lilies in reservoir.

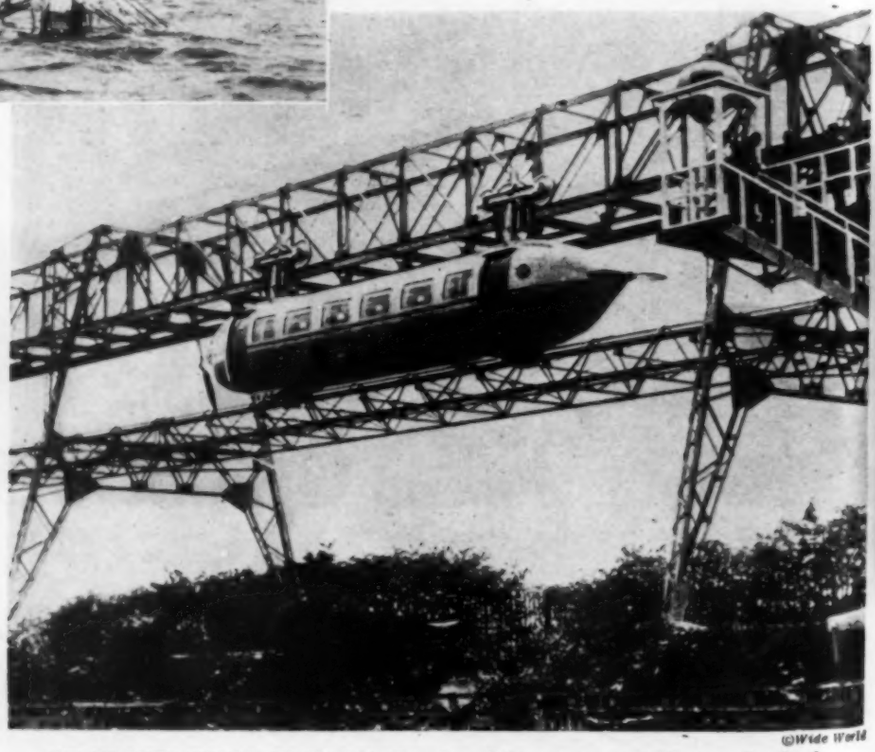
JOB ODDITIES

A Monthly Page of Unusual Features of Construction



NEW-STYLE MARINE BORER *(left)*. Rigidly moored steel tower, 2 ft. square, aids core-drilling operations in 60 ft. of water at site of south pier of proposed Golden Gate bridge.

SMALLER THAN WRIST WATCH, Westinghouse's tiniest motor, rated at approximately $\frac{1}{4}$ cricket-power, is used in delicate devices which require constant speed with very little power.

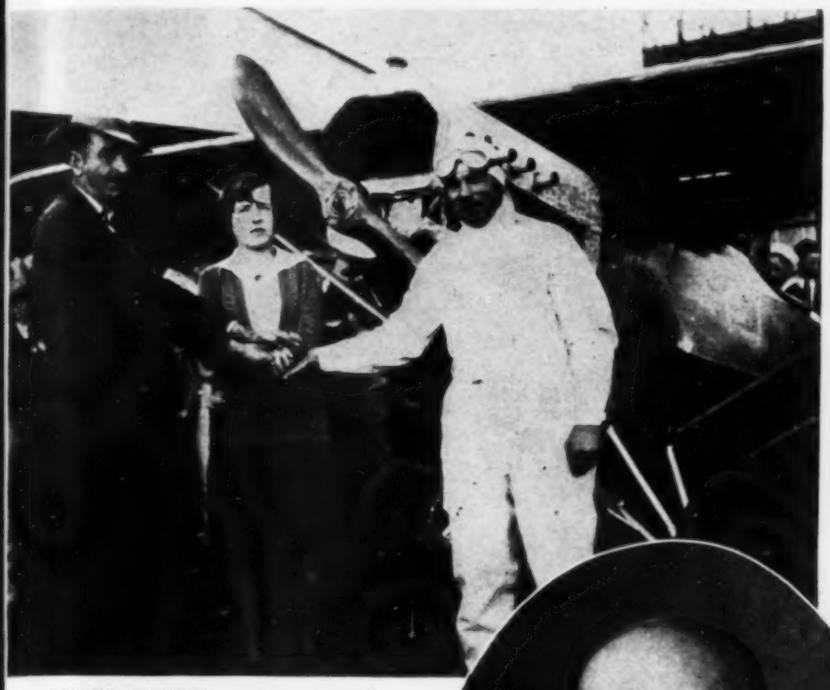


©Wide World

AIR TRAVEL ON SOLID BASIS! Bennie railplane system at Glasgow, Scotland, introduces rapid transit passenger car moved by air propellers and suspended from elevated rail. Car is leaving station, at right.

Present and Accounted For —

A Page of Personalities



ALVIN PETERS, contractor, of Salinas, Calif., pilots his own airplane. The ship is powered with a new Ford motor turning a 6-ft. propeller at 2,200 r.p.m. The machine attains a speed of 85 miles per hour.

STANLEY ABEL, member of the Board of Supervisors of Kern County, Calif., is the new president of the County Officials' Division of the American Road Builders' Association. He presided at a meeting of the division's executive committee in St. Louis last month to consider all phases of the county highway problem.

Photo Pirie MacDonald

COL. W. A. STARRETT, of Starrett Bros. & Eken, Inc., contractors, heads a syndicate that will build at 342 West 42nd St., New York, the new 26-story McGraw-Hill Building to house "Construction Methods" and the other McGraw-Hill engineering and industrial publications. The architects, Raymond Hood, Godley & Fouilhoux, have retained Lockwood Greene Engineers, Inc., as consulting engineers on the new structure, which will have a floor area of 500,000 sq. ft.

WARD P. CHRISTIE, *(below)* after ten years of service as engineer for the Associated General Contractors of America, with headquarters in Washington, D. C., has resigned to become associated with Ulen & Co., international contractors, of Lebanon, Ind. Mr. Christie's new duties will include research and investigation and international liaison work.

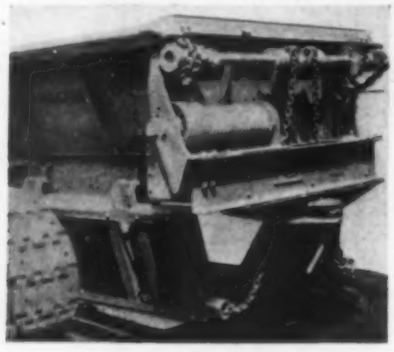
©Harris & Ewing

CHARLES E. GRUBB, formerly county engineer of New Castle County, Del., has joined the staff of the American Road Builders' Association as executive engineer in charge of the organization's County Officials' Division. Mr. Grubb is a past-president of the division which he now manages.

NEW EQUIPMENT ON THE JOB

Simple Wagon Door Control

An easily operated door control for its crawler dump wagons, which may be attached in the shop or fields, has been developed by the Western Wheeled Scraper Co., Aurora, Ill. The Western spring wind-up, as it is called, consists of a large spring to close the doors tight, a toggle and ratchet arangement to hold them closed



against a load or to open them against spring pressure and a pawl and ratchet device to trip the load or close the doors when the wagon has been emptied. The mechanism is controlled by the tractor driver or the man at the dump, thus eliminating need for a man to trip and wind up the doors.

A Sturdy 27-E Paver

Greater simplicity and sturdiness are two of the qualities claimed for the new 27-E Master Paver recently placed on the market by the Ransome Concrete Machinery Co. of Dunellen, N. J.

In this latest model the reduction gearing, the two-speed forward and

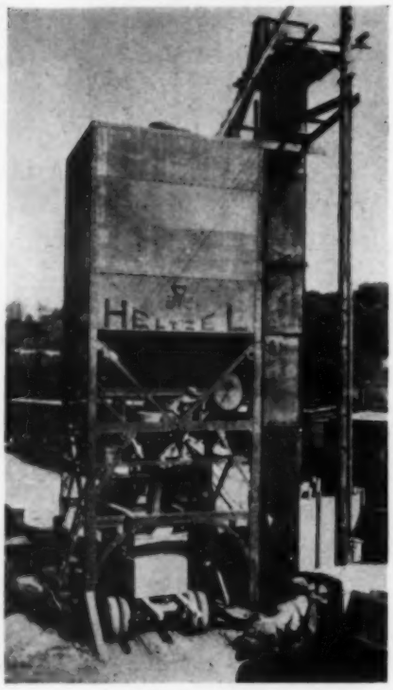
reverse drive and level gears for traction have been housed in an oil-tight gear box mounted on three-point suspension, with the clutches on the outside.

The 12- and 15-in. channels and the 12-in. I-beams comprising the main frame are completely welded. In tests the 4½-in. axle has borne a 38-ton load. The crawler drive chain has 85,000 lb. breaking strength. To raise and dump a load into the 66-in. drum, the power loader requires 10½ to 11 sec. The drum discharges a full load in 8 sec.

Bulk Cement Plant

A complete plant for storing and batching bulk cement is now provided by the Heltzel Steel Form & Iron Co., Warren, Ohio.

The basic bin of this plant is a portable, all-riveted bin having a capacity, with extension of 320 bbl. It is loaded



by a vertical elevator and the flow of cement from the bin to the dust-proof batcher is controlled by a rotary valve arrangement. Weighing is done with an automatic, springless, dial type of scale which permits back-checking without moving any counterpoises.

Adds Five Trucks to Line

Five dump-body trucks have been added to the line of standard Model AA 1½-ton trucks by the Ford Motor Co. They are designed to meet the requirements of almost every kind of hauling in which a body of this type is used. Bodies are made of one piece of steel, with no center or bottom seams to interfere with the free flow of materials.

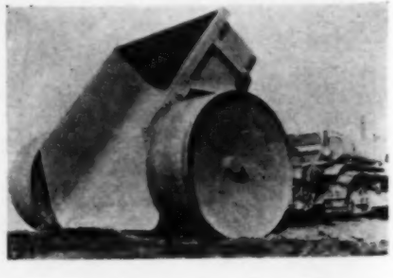
Gasoline-Driven Saw

A portable sawing machine equipped with a 4-hp. gasoline motor and adapted for cutting large timber, as well as for felling and bucking trees, is a recent product of the Reed-Prentice Corporation, Worcester, Mass.

This machine may be had in 16- and 24-in. sizes and is made with a swivel movement so that cutting can be performed either vertically or horizontally, allowing the engine to remain in a vertical position. The saw will cut about 28 cords of pulpwood a day in comparison to 12 cords which could be cut by hand in that time by two experienced men.

Chariot-Type Dump Cart

Several years' experience in building wagons for earth moving has resulted in the manufacture by R. G. Le Tourneau, Stockton, Calif., of a chariot-



type dump cart weighing 7 tons empty, for long distance hauling.

The body of this cart is 9x11x4 ft. and holds 12 yd. water level or 16 yd. heaped up. It is easily dumped by a power control unit operated by the tractor driver. The wheels are 78 in. in diameter with a 30-in. face which makes it possible for the cart to travel over soft material. It also is possible to haul in this cart rocks 8 or 9 ft. through.

Mobility counts in getting on and off a steel erecting job. Many steel erectors rent Universal machines from local crane service companies.

A Crane that is always loaded and ready to go

THE job may be a half mile away, or 125 miles away . . . it doesn't make any difference to a Universal Truck Crane . . . it is always ready to go. No time or expense getting it loaded, no need to dismantle the boom, no time lost to unload . . . the Universal Truck Crane is ready for instant travel, ready for instant operation the minute it gets to the job.

THE UNIVERSAL CRANE COMPANY
Lorain, Ohio

Handling small clamshell excavating jobs with the Universal Truck Crane is cheaper than with crawler cranes, faster than hand labor.

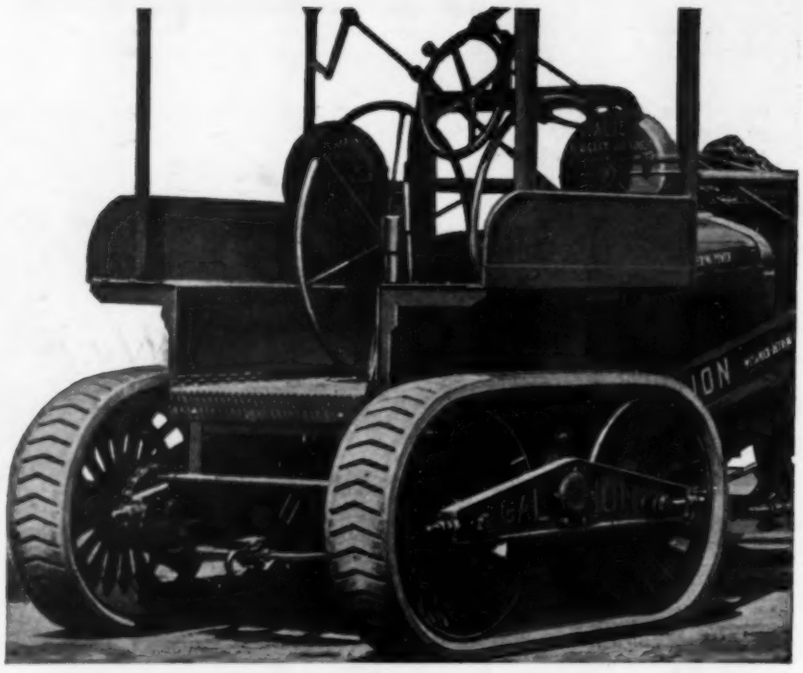
Motor Truck (Christie) Crawler gives the Universal Truck Crane rubber tired speed on pavement, crawler traction anywhere.

UNIVERSAL

Universal machines are transferable to crawler mounting—mounted on the famous Thew 2 Speed Center Drive Crawler.

The Universal 35, ½ yd. shovel with Center Drive shovel boom has the greatest reach of any shovel with equal length boom and dipper stick.

Sure-trac Rubber Crawler



A Feature of Galion E-Z Lift Motor Graders

Galion's recent development in Motor Grader construction, the Sure-Trac Rubber Crawler, eliminates entirely the objectionable features found in steel crawlers. For example, sand, which sets up a grinding action between the sprockets and steel plates of metal crawlers, causing great wear to both, has no effect upon the rubber crawlers — there are no links or sprocket teeth.

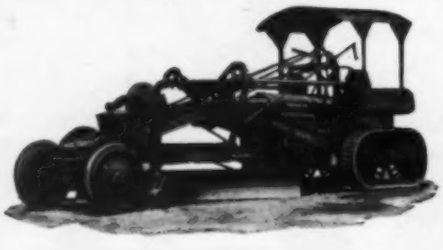
Galion Rubber Crawlers also provide:

GREATER TRACTION—greater flexibility of the continuous rubber track provides positive traction under all working conditions. Gripping action of rubber easily carries the crawler over large stones or rough soil.

GREATER OPERATING ECONOMY—a guarantee of 5000 miles of service, backed by the world's largest tire producer. A rubber crawler, after traveling over 17,000 miles in sand territory, showed little wear.

LESS VIBRATION — destructive vibration, caused by the flopping action of metal links or plates is replaced by the smooth, cushioned surface of the rubber track. Wear on tractor and grader parts is substantially reduced and real comfort is provided for the operator.

HIGHER SPEED—rubber track is designed and constructed to stand up under a much higher speed than any steel crawler ever designed.



A bulletin describing Galion Sure-Trac McCormick-Deering Graders will be sent on request.

The Galion Iron Works & Mfg. Co.

Galion . . . . Ohio

Galion Distributors

W. A. Adams Tractor & Equip. Co., Raleigh, N. C.
R. S. Armstrong & Bro. Co., Atlanta, Ga.
O. B. Avery Co., St. Louis, Mo.
Badger Tractor & Equip. Co., Milwaukee, Wis.
W. D. Banker Road Machy. Co., Memphis, Tenn.
Banks-Miller Supply Co., Huntington, W. Va.
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Brown-Fraser & Co., Ltd., Vancouver, B. C.
Dukehart Machy. Co., Des Moines, Iowa
Eastern Tractor Co., Cambridge, Mass.
Feenaughty Machy. Co., Portland, Ore.
Frankfort Equip. Co., Frankfort, Ky.
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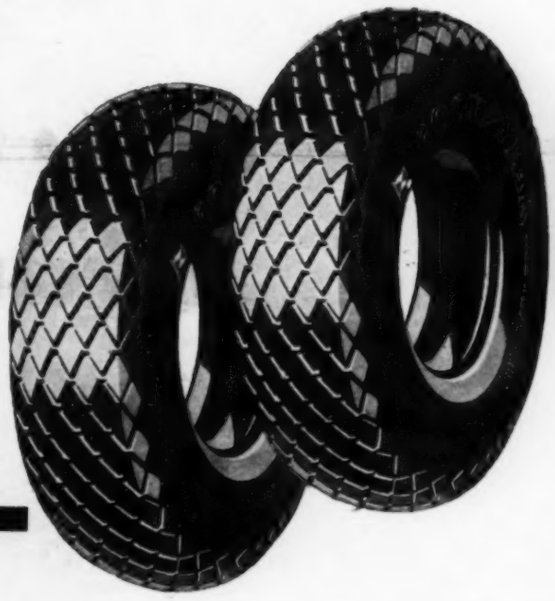
Jeffrey Mfg. Co., Ltd., Montreal, Que.
Jenison Machy. Co., San Francisco, Cal.
C. H. Jones Co., Salt Lake City, Utah
Lewis-Patten Co., San Antonio, Texas
Lewis Tractor & Machinery Co., Fargo, N. D.
Miller & Requarth, Springfield, Ill.
Morrow Auto Co., Albuquerque, New Mexico
H. W. Moore Equip. Co., Denver, Colo.
Morrisey Easton Tractor Co., Vicksburg, Miss.
Murphy & Murphy, Little Rock, Ark.
Northfield Iron Company, Northfield, Minn.
C. T. Patterson Co. Inc., New Orleans, La.
G. C. Phillips Tractor Co. Inc., Birmingham, Ala.
Power Equip. & Service Co., New Haven, Conn.
F. Ronstadt Co., Tucson, Ariz.
Salina Tractor & Thresher Co., Salina, Kan.
Bert Smith, Enid, Okla.
Smith-Booth-Usher Co., Los Angeles, Cal.
Standard Road Equip. Co., Rockford, Ill.
W. H. Stoutenburg, Penn Yan, N. Y.
Tennessee Tractor Co., Nashville, Tenn.
F. E. Vaughn, LaCrosse, Kan.
Virginia Road Machy. Co., Richmond, Va.
Welch Good Roads Supply Co., Welch, W. Va.

THESE GREAT



BALLOONS

ARE BRINGING DOWN

CONSTRUCTION

HAULING COSTS

It was a big event for truck owners when Goodyear developed truck balloons.

Now that trucks are built for speed, these newest Goodyear tires deliver all the advantages to trucks which balloon tires brought to passenger cars.

Because they absorb the jolts, they protect the truck mechanism —reduce vibration—bring down maintenance and repair costs. They protect the load from jars—they enable trucks to cover more miles per day, make more deliveries per day, because they travel faster, hold the road on curves, and provide greater traction on or off the pavement.

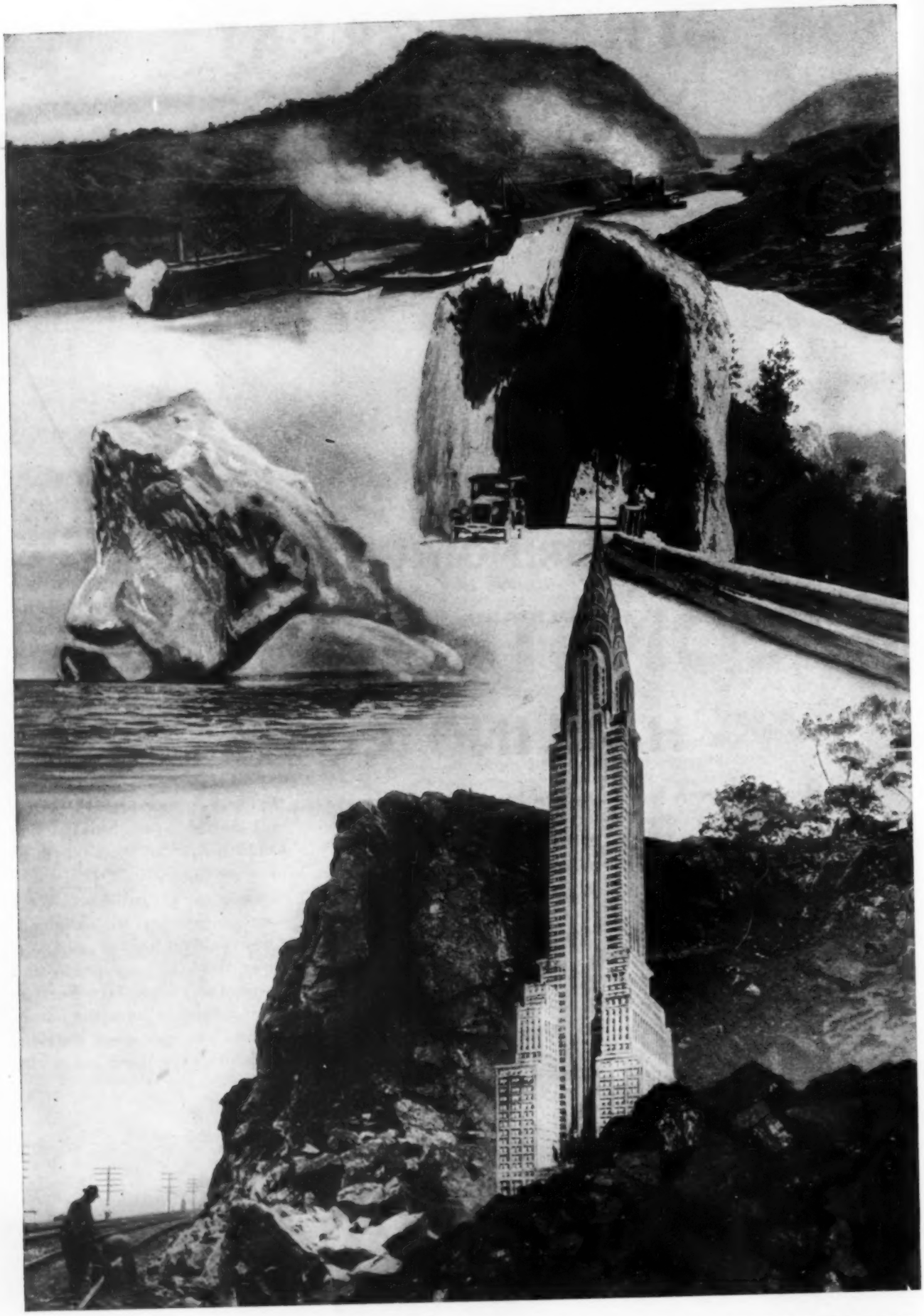
And beyond all that, these new Goodyear Truck Balloons make the tire cost per mile lower than it has ever been under similar operating conditions. They stand up under the heat of fast driving — they decrease tire injuries that cause road delays — they roll softly over bumps that would break down many a high pressure tire.

When you get balloon tires for your trucks, get the originals. Goodyear pioneered and perfected truck balloon tires — and Goodyear Truck Tire Service Station Dealers have the advantage of the greatest balloon truck tire experience in the tire industry.

ON YOUR NEW TRUCKS, SPECIFY GOODYEARS

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TIRES THAN ON ANY OTHER KIND



POWER

efficiency . . . economy

No matter what your blasting operation, there's a du Pont explosive to meet your need

IN specifying explosives for different types of blasting, much depends on the kind of explosive. So when you select an explosive for a given job, you want to know these things: How well will it do the job? Has it been made especially to meet and overcome certain conditions? Is it economical to use?

These are just a few of the questions the du Pont Company has asked about explosives in the 128 years it has been making them. Every sort of blasting encountered in the United States has been studied by expert technicians so that the du Pont Company might be able to improve its own explosives . . . might be able to introduce new explosives that would more fully meet your requirements.

The fact that most of the new improvements in explosives have been brought forward by du Pont accounts for their leadership in the field. The reason you can specify du Pont explosives with full assurance is that there is a du Pont explosive specifically designed for *your* job.

For coal mining . . . the du Pont Permissibles and Pellet Powders. For clay, ore, salt and gypsum mining . . . Durox, Gelex, Extras. For quarrying, for road and railroad construction . . . Gelatins, Extras. For excavating, tunneling, shaft sinking . . . the Special Gelatins. And so on.

The du Pont Company publishes a series of Technical Bulletins dealing with methods of blasting, and describing du Pont explosives. These bulletins can help you solve your blasting problems.

We shall be glad to place your name on our lists to receive these bulletins. Write direct.

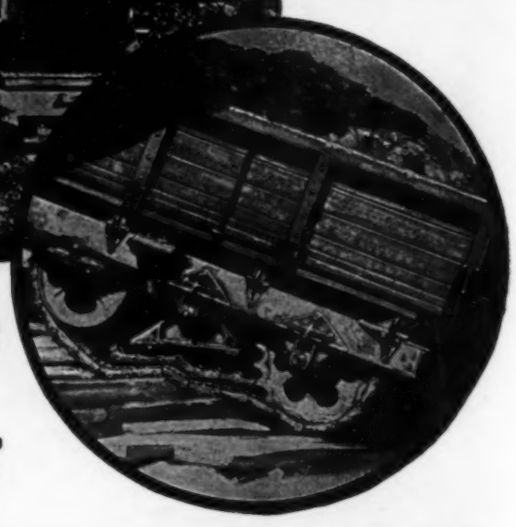
DU PONT
REG. U.S. PAT. OFF.

E. I. DU PONT DE NEMOURS & CO., INC.

Explosives Department **Wilmington, Delaware**

Another Certified Performance Survey Made by Independent Cost Engineers

One of two tractors operated by the P. B. Brown Excavating Company, Hazelton, Pa. These tractors for two years have given low cost performance over jagged rocks, through deep pit mud and with grades up to 37 per cent.



HERE ARE FACTS OF POCKET BOOK $ INTEREST TO *EVERY* EXCAVATING CONTRACTOR

A. C. Nielsen Company, Independent Cost Engineers, gives these facts after a survey of the strip mine operation of the P. B. Brown Excavating Company.

Fact 1. Two Linn tractors have moved all the coal from shovel to chute for the operators of a strip mine near Hazelton, Pa., since September 1928.

Fact 2. Pay loads averaged from 5½ to 7½ tons under all conditions.

Fact 3. No time lost for repairs of any kind during the first years of service.

Fact 4. Hauling costs per ton ranged from .110 on rock and mud bottoms to .243 in three feet of mud.

Tractors work in such close quarters that often the trip ⅛ to ⅝ mile one way has to be made in reverse. The Linn 4-speed reverse permits speeds of from one to six and three-quarters M.P.H. We shall be glad to send complete copy of this independent survey and other interesting data on request.

Hauls Pay Load As It Makes Its Own Road

1. *Patented Flexible Traction* that grips any surface under all weather conditions.
2. Tremendous hauling power—100 horsepower to take full advantage of Linn Traction.
3. Ten ton capacity on its own chassis.
4. Extra traction and power for additional tow loads.
5. Easy on men—steers like a truck.
6. Four speeds forward with four speeds reverse optional.

LINN MANUFACTURING CORPORATION

Division of LaFRANCE-REPUBLIC Corporation

Manufacturers of American La-France Trucks, Linn Tractors, Republic Trucks

Factories: Alma, Mich. • Morris, New York

Represented in:

New York City	Boston	Philadelphia	Chicago	Tulsa, Okla.	Salt Lake City	San Francisco
Skowhegan, Maine	Charlotte, N. C.	Pittsburgh	St. Louis	Omaha, Nebr.	Denver	Portland, Ore.
New Haven, Conn.	Memphis, Tenn.	Louisville, Ky.	Kansas City, Mo.	Sioux Falls, S. D.	Jerome, Ariz.	Spokane
Baltimore	Johnson City, Tenn.	Detroit	Little Rock, Ark.	St. Paul, Minn.	Los Angeles	

105 direct distributors located throughout the United States and 49 distributors located in 30 foreign countries

Canadian Linn Distributors: Mussens Limited, Montreal

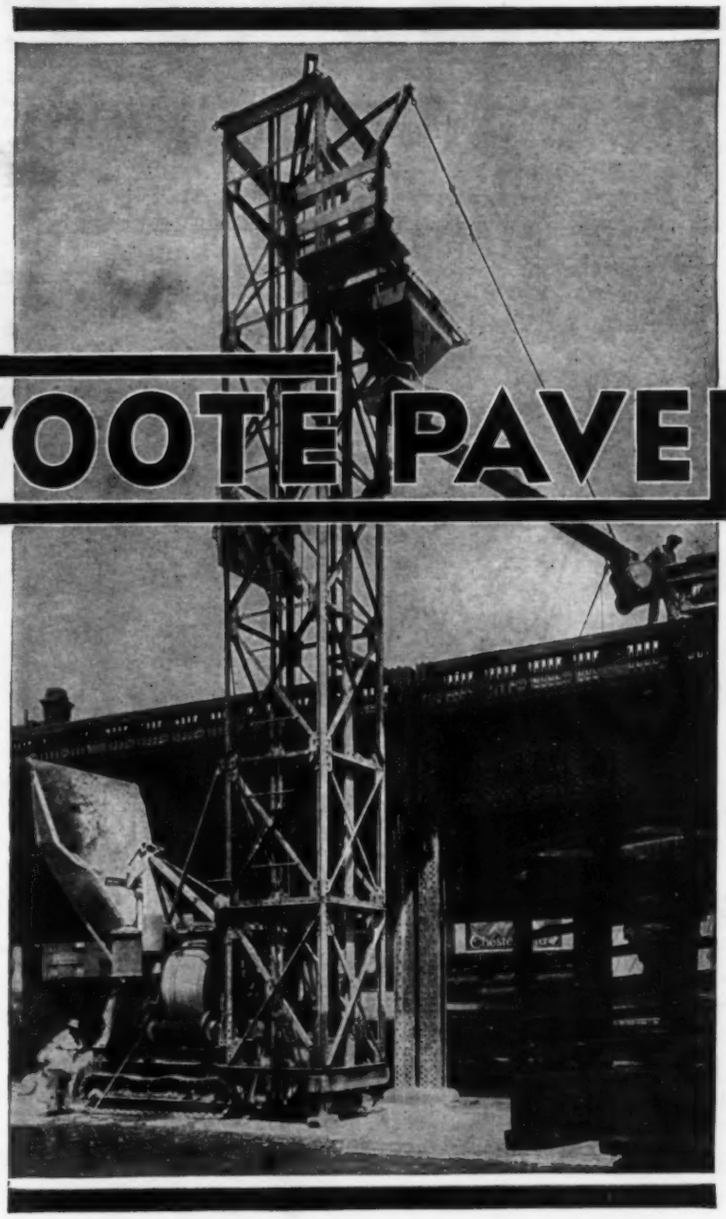
LA FRANCE REPUBLIC LINN TRACTORS

Patent No. 1,270,831
Patent No. 1,621,464
Patent No. 1,665,641
Patent No. 1,665,676
Patent No. 1,701,979
Other Patents Pending

Speeding New York's Overhead Highway with a—

MULTI FOOTE PAVER

and Tower Equipment



A Portable Outfit. Quickly Moved on MultiFoote Traction

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612 N. Michigan Ave., Chicago, Illinois
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31 Crestmont Road, Binghamton, N. Y.
BURTON FRANKLIN CO.
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134 Pierpont Ave., Salt Lake City, Utah
LONDON CONCRETE MACHINERY CO.
London, Ontario, Canada

For Spreading Concrete at high elevations or over wide areas, the MultiFoote 27E is now specially equipped to mount and operate a Tower Equipment.

A Road Paver with Boom and Bucket or a Building Mixer for wide range work.

MultiFoote's Record for Speed, Perfect Mixing Action and Dependability makes it the outstanding Paver.

For full particulars, address any MultiFoote Distributor or—

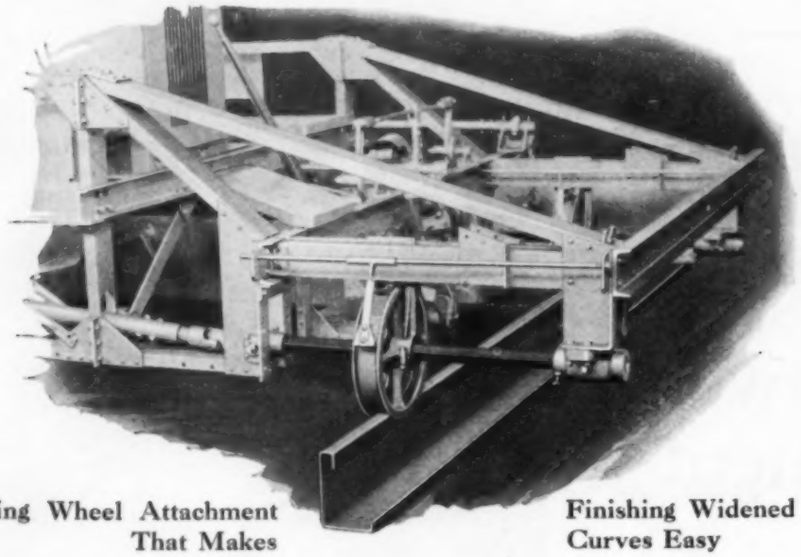
THE FOOTE COMPANY, Inc., NUNDA, N. Y.

World's Largest Exclusive Builders of Road Pavers

SPEED!

FOR 9 AND 10 FOOT ROADS . . .

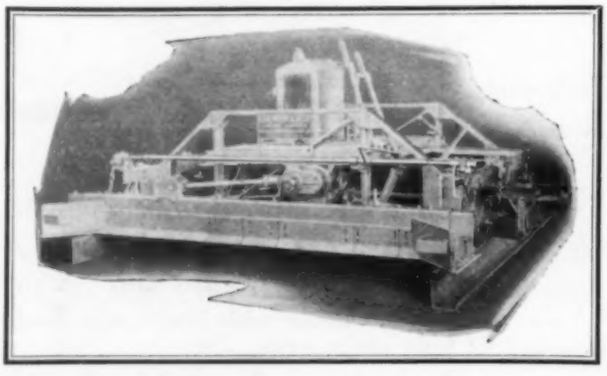
THE LAKEWOOD TYPE C. FINISHER



Sliding Wheel Attachment That Makes Finishing Widened Curves Easy

Plenty of speed to keep up with the paver at all times—12 feet per minute forward—75 feet per minute reverse—that is the Lakewood Type C. Finisher. It will make you records on 9 and 10-ft. roads.

Two screed members, each 12 in. wide. Each may be given slight tilt for true trowelling action. Combined Screed and Tamper if wanted.



Sliding wheel fixture enables you to finish widened curves with the machine without false forms. Adjustable for both 9 and 10-ft. roads. Type C., by changing cross members, may be used on roads up to 30 foot width.

Type C. has full automotive construction — heat treated gears and shafts — Timken Roller Bearings, enclosed automotive type transmission.

Get the details on this machine—write for special bulletin.

EXPORT OFFICES: 30 Church St., New York City - - *CABLE ADDRESS:* Brosites

LAKEWOOD

The Lakewood Engineering Co., CLEVELAND - O.

THERE'S a place for all things—and shallow grading work in cutting in subdivision streets is a place for the Haiss Excavator. These machines at work in different places, have been taking out 500 yards in 9 hours, 350 yards in an 8-hour shift, 630 yards in 8 hours, 46,340 yards in a season, etc., depending on digging conditions and the number of trucks available.

It digs without plowing — in anything that will yield to pick and shovel. *It digs continuously* — a positive nibbling action that tears out surprising yardage. *It will stand the gaff*—one recent report shows repairs @ 15/100c. per yard handled.

Going after shallow grading? Then figure costs on a Haiss Excavator basis and save money. A post card will bring a catalog.

HAISS

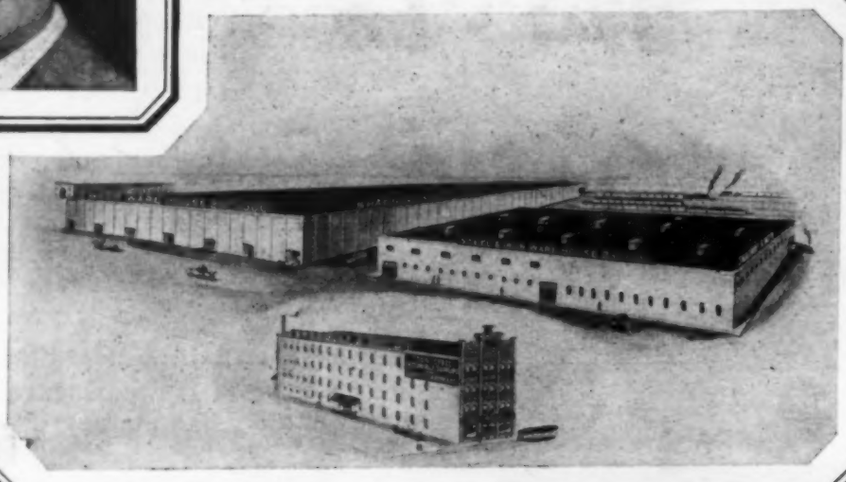
EXCAVATOR

"up to 2 cu. yds. per minute"

for Street Grading

H-671

"Here's Another Way We Help You to Save



Above—Mr. Price M. Davis, President of The Shadbolt & Boyd Company of Milwaukee, Wisconsin. This company's services are of a definite economic value to the prosperity of its business territory.

OUR salesmen become better acquainted with local conditions than any manufacturer's salesman—they understand what is needed and wanted—they appreciate and sympathize with individuals and companies—they understand our locality because they and their families are local—they are as smart and efficient in your behalf as any set of men—and—they recommend Republic's Belting—Hose—Packing—Molded and Lathe Cut Goods."

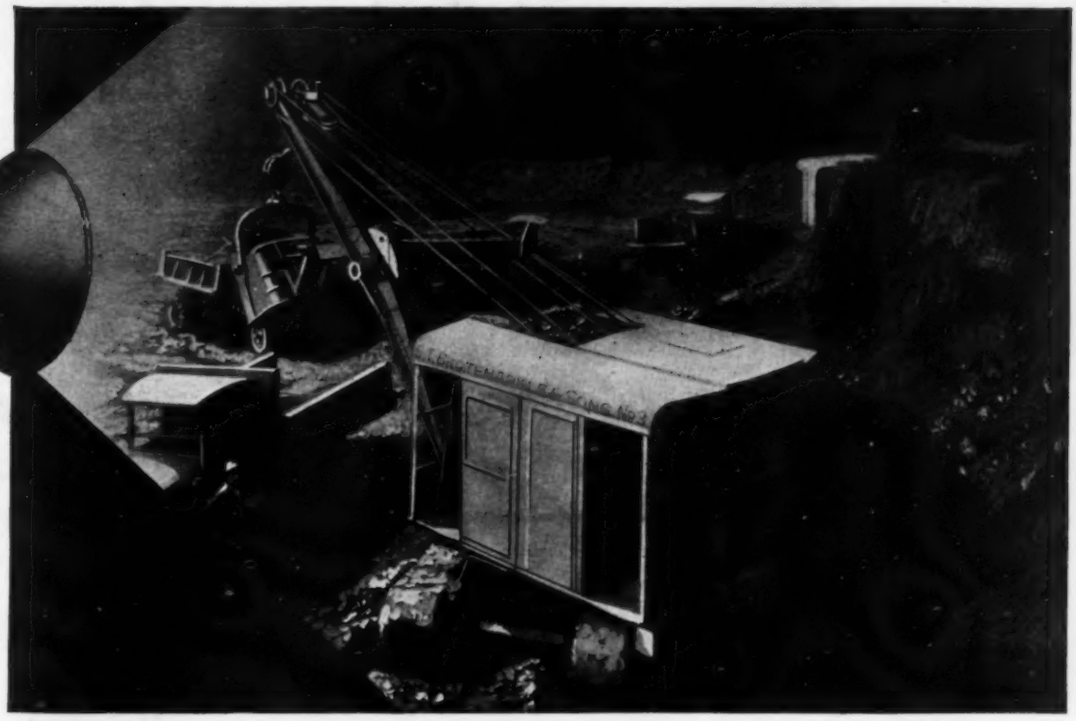
The above statement is characteristic of those made by prominent distributors all over the country. It explains in part how the Industrial Supply Distributor, helping to solve the important problem of broad markets and economical distribution, upholds high quality, maintains fair prices and saves needless efforts on the part of both consumer and manufacturer.

Tonka Water Hose made in sizes ¾ in. 2 ply to 1½ inch 3 ply inclusive. Tonka has a strong body and a cover stock that resists abrasion to the maximum, with strong live adhesion to keep the cover in place. This protects the hose from weather and abuse and insures long life.

THE
REPUBLIC RUBBER CO.
Youngstown
Ohio

REPUBLIC means the Best Mechanical Rubber Goods

WHEN EVERY HOUR COUNTS



WHEN your work falls behind schedule, and every hour counts—put Carbic Flood Lights on the job. Their powerful, clear, and diffused light rays enable your men to work after dark as rapidly and safely as by day. They are insurance against penalties.

Carbic Flood Lights are portable. Any workman can operate them. They last indefinitely. Initial cost is low, and the operating expense is negligible. Your name and address sent in on the coupon below will bring you complete information about every model.

OXWELD ACETYLENE COMPANY

Unit of Union Carbide UCC *and Carbon Corporation*

NEW YORK

Sales Offices in Principal Cities

Carbic is distributed by the Union Carbide Sales Company through its national chain of warehouses and is sold by jobbers everywhere.

Technical Publicity Dept., 205 East 42nd Street, New York, N. Y. 12th floor

Without obligation, I would like to have additional information on Carbic Lights.

Name..... *Street Address*.....

Company..... *Position*.....

City..... *State*.....

C.M.Sept.

Wehr 3 to 7 Ton Road Roller

The New Wehr A-4 Grader

The Complete Wehr Line Builds and Maintains Good Roads and Good Profits

WEHR—The Pioneer—offers a line of road building and maintenance equipment that demands the attention of every highway man, township, county and state highway official!

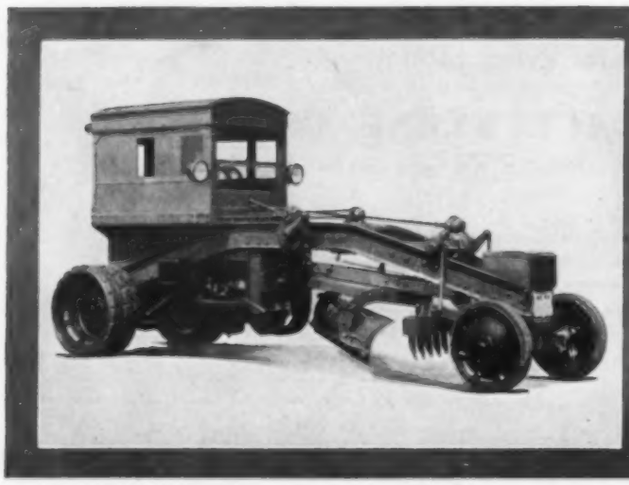
For every road construction and maintenance project, there's a Wehr unit to fit the job. Wehr One Man Power Graders, especially the new A-4 and the improved U-4, offer a large number of engineering features procurable in no other grader. The Wehr 3 to 7 Ton Road Roller is famous for its ruggedness and durability, apparent in the massive construction of this highly adaptable unit. Wehr also offers a new and complete line of pull-type graders, designed and built to handle every type of road work.

The development of the Wehr line is the result of the Wehr complete-service policy. A capable engineering staff, and a modern factory using up-to-date equipment, unite to produce road-machinery that is well-known throughout the world. Less cost and greatest production per mile of service are the results of Wehr construction, giving greater investment returns to the buyer of Wehr equipment. Write for full details of the Wehr line, stating what equipment you are particularly interested in.

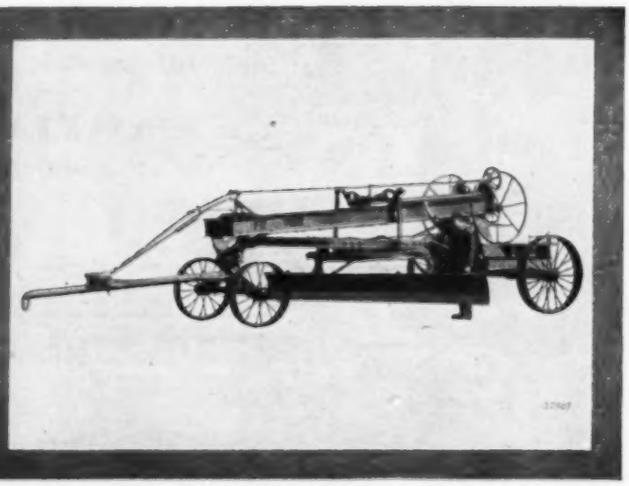
WEHR COMPANY, *Milwaukee, Wis., Factory: Cudahy, Wis.*

WEHR

ROAD BUILDING AND MAINTENANCE EQUIPMENT

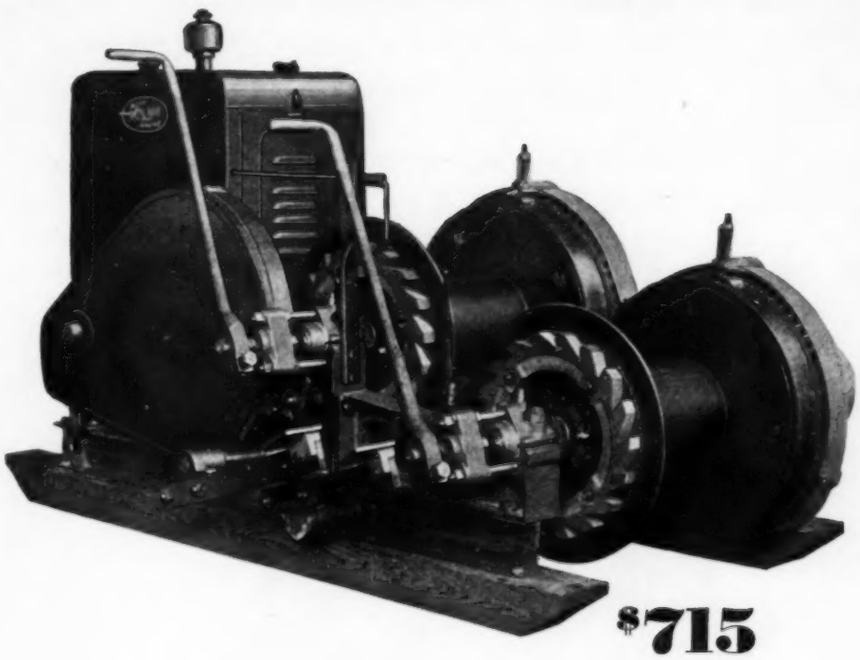


The Improved Wehr U-4 Grader



The New Wehr P-12 Pull-type Grader

Match This 4-Cylinder Roller Bearing Engine and Double Drum Hoist, *If You Can, at Any Price*



$715
F. O. B. LANSING

1

The NH 165 has a double cone, six section, wood block, renewable friction —instead of the ordinary single cone friction cast integral with the drum gear.

2

Instead of releasing drum from friction by pulling it off with a friction lever, the NH 165 has a release spring on the drum shaft.

3

A one-piece brake on this Novo gives ⅓ more braking and a far more effective braking action than the two-piece brakes usually used.

4

The ratchet is bolted to the drum and can easily be replaced if broken. On others, the ratchet is cast integral with the drum.

5

Drum shaft bearings are of pillow block construction with stud bolts—instead of flat cap bearings with through machine bolts.

6

The pawl and brake shafts are separate on the NH 165. On others, where the pawl or dog is mounted on the brake shaft, the brake is absolutely useless when the pawl is engaged. This means that when a load is suspended in mid-air, and held there by the pawl, accidentally jarring the foot brake can throw the pawl out.

7

The NH 165 has a real screw thrust—not a cam thrust.

8

The side frames are separate from the base. And the base is of welded steel construction with tubular spreaders to maintain alignment and give additional strength. This is far superior to having the side frames and base all in one piece—and depending on wood skids for alignment.

9

A Novo four-cylinder, anti-friction engine, with Timken Roller Bearings on crankshaft and driveshaft, supplies the power. Vibration is virtually eliminated. Horsepower is increased. Gas consumption is less. And operation is extremely smooth and dependable. Extended hand throttle convenient for operator.

THIS Novo NH 165 double drum hoist is built to give contractors a fast, over-strength machine for handling platform elevators and concrete buckets on the average building job.

Feature for feature, it is a 100 h. p. hoist on a 14 h. p. scale.

That is why it stands out so far ahead of competition.

Try to find the hoist that matches it in design, construction, performance and price.

This coupon will bring you complete information for which we haven't room here. Send that coupon today.

NOVO
PUMPS—ENGINES—HOISTS

NOVO ENGINE COMPANY
214 Porter Street, Lansing, Mich.
Clarence E. Bement, Vice-Pres. and Gen. Mgr.

Please send me complete details on the Novo NH 165 double drum hoist.

Name.....

Address.....

Company.....

City.....*State*.....

"Here, Lad—

Your friend 'Arc Welding' is an interesting character and should work out well with machine builders who must keep their product up to date.

But as to his future in this structural field of ours, I'm from a middle-west state."

"Sure, Pop—

You mean that state that is 'out where the Test begins'. Now his work has been put to the test on architectural problems too many times to think that his work is in the future.

One of the most interesting ones I've read about is that shown on Plate 15 in the series 'Studies in Structural Arc Welding.'

These are being published by Lincoln Electric, makers of the well-known 'Stable-Arc' welder, for the benefit of architects, general contractors, building inspectors and steel fabricators.

This Plate 15 opens a treatise on the design of a truss for a mill building.

This promises to be the most comprehensive study of arc-welded design available and is based on an actual problem of *today*. Arc welding is closer to today's problems than most men imagine. The fellow who has no future is the one who thinks that the future is *tomorrow*."

The Lincoln "Stable-Arc" Welder

— welds easier
— makes better welds
— permits greater output because of the steady uniform arc throughout entire welding range, which is the result of:

- **Variable voltage design**
- **Laminated magnetic circuit**
- **Separately-excited generator field**
- **Double control of welding heat**
- **All steel construction**

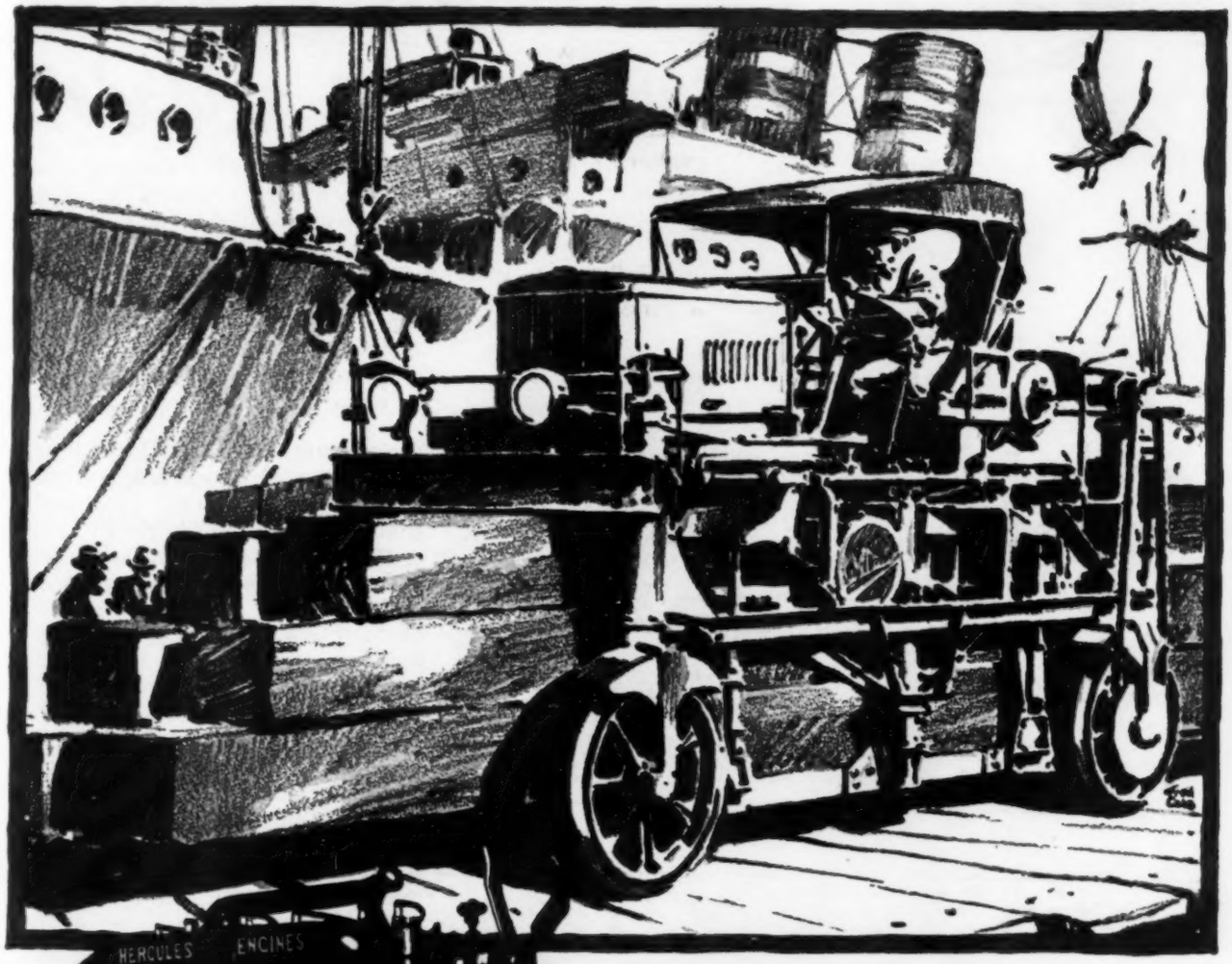
No other welder has all these features.

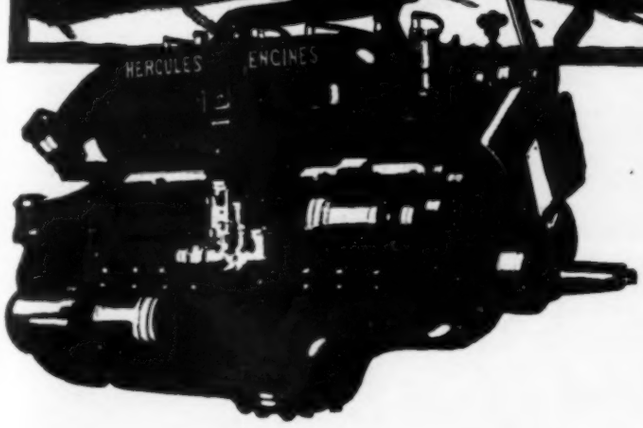
The Lincoln Electric Co., Dept. No. 32-9, Cleveland, O.

LINCOLN "Stable-Arc" WELDER

W-156

HERCULES ENGINES POWER THE WILLAMETTE CARRIER





Hercules Engines are built in a complete line of Four and Six cylinder models ranging in size from 9 to 175 H. P. Hercules engineers understand the power problems of manufacturers of contractor's, road building and general-industrial equipment. These are two of the many reasons Hercules Engines power Willamette "Utility" Carriers—and are standard on a wide variety of heavy-duty power machinery.

HERCULES ENGINES

HERCULES MOTORS CORPORATION
Canton, Ohio, U. S. A.

West Coast Branch: San Francisco, Cal.
Mid-Continent Branch: Tulsa, Okla.
Eastern Branch: New York, New York

Distributors: Smith-Booth-Usher Co., Los Angeles, Cal.; Edward R. Bacon, San Francisco, Cal.; F. C. Richmond Machinery Co., Salt Lake City, Utah; Worthington Machinery Corp. of Oklahoma, Tulsa, Okla.; Norvell-Wilder Supply Co., Beaumont, Tex.; Bovaird & Co., Bradford, Pa. European Distributor: Automotive Products Co., London, Berlin, Vienna.

GENUINE OPEN HEARTH IRON
GOHI
TRADE MARK
PURE IRON - COPPER ALLOY
REG. U.S. PAT. OFF.

(Meet copper-bearing pure iron requirements in all accepted specifications for corrugated metal culverts.)

Corrugated Culverts Protect the grass . .

"that costs $1.00 a blade"

THE "greens" on a golf course are just about the most expensive stretches of turf in the world. They are cared for as carefully as an oriental rug.

Many golf courses protect their investments in "greens," and at the same time add to the pleasure of the game, by taking care of drainage with GOHI Culverts.

The pictures show a GOHI installation on the Biltmore Course near Asheville, N. C. Although less than a foot under ground, the GOHI Culverts withstand perfectly the weight of the heavy lawn rollers and mower-pulling tractors.

Made of Genuine Open Hearth Iron — pure iron-copper alloy — to defeat the ravages of time, GOHI Culverts prove themselves better . . . in actual practice . . . for every culvert job. Easy to handle. Quick to install. Flexible to prevent breakage. Strong to withstand the weight of heavy fills.

The same qualities of excellence that make GOHI Culverts the choice for the Biltmore Golf Course, are the reasons why you should use GOHI for all highway drainage and other culvert installations.

Get the facts . . . all the facts . . . and you'll specify, and *insist* on GOHI Corrugated Culverts.

Use GOHI Culverts for

Highway Drainage
Airports
Storm Sewers
Railway Roadbed Drainage
Real Estate Developments
Golf Courses
Drainage of reclamation areas
Temporary or permanent Flumes.
Reservoir Syphons and Outlets

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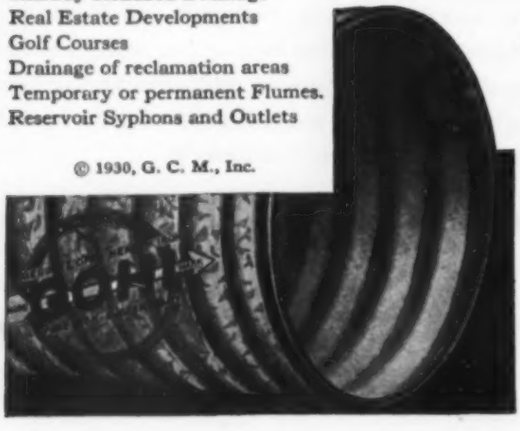

GOHI CULVERT MANUFACTURERS, Inc., Newport, Ky

Lincoln Steel and Forge Co.
St. Louis, Mo.

The Newport Culvert Co.
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Tennison Brothers
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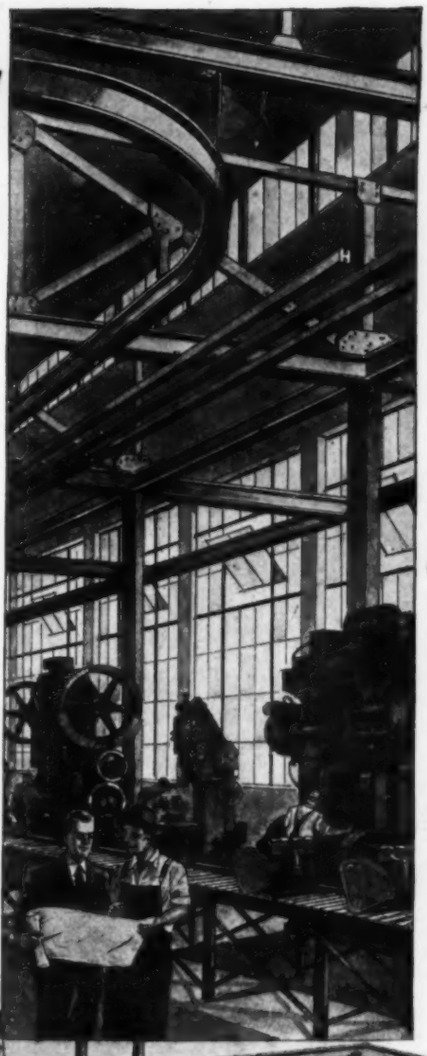
SINGLE UNITS *or* COMPLETE PLANTS

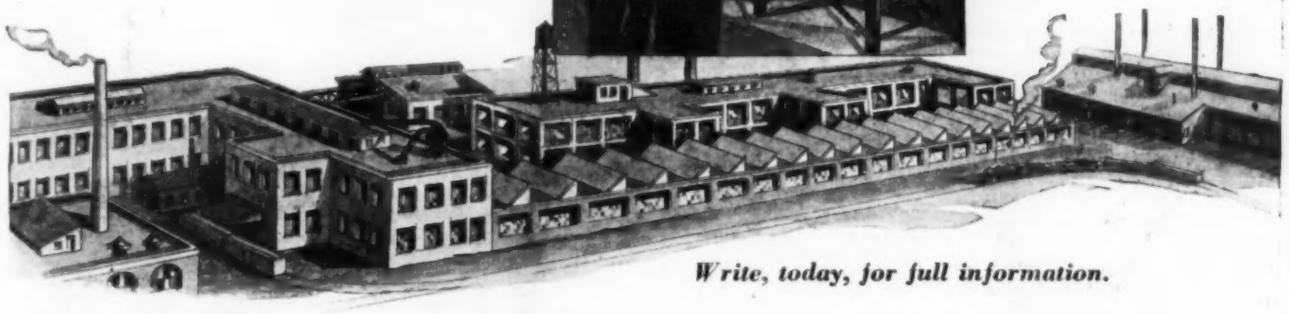
INDUSTRY'S need of modern machinery and equipment has created a far-reaching demand for sound and constructive deferred payment financing. In this age of keen competition the manufacturer with a modern plant holds the whip over selling quotations.

Modernization requires no large cash outlay. Commercial Credit Plans designed to allow payment for modern machinery and equipment from its earnings have proved sound in practice. They have made lack-of-ready-cash a poor excuse for obsolescence.



COMMERCIAL EQUIPMENT CORPORATION

Commercial Equipment Corporation, affiliation of Commercial Credit Companies, provides a further financing service to industry. Its method of financing complete installations as a unit, requiring two or more varying types and makes of equipment, has been approved and endorsed by many of the country's leading engineers.



Write, today, for full information.

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COMMERCIAL BANKERS

CASH CAPITAL and SURPLUS $58,000,000

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NATIONAL HEADQUARTERS, Baltimore

S.P. 34

COMMERCIAL CREDIT COMPANIES, Baltimore, Maryland
Give us full information, without obligation, about Commercial Credit Plans.

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SAFE
BIGGS WELD
DUCTILE
UNIFORM
STRONGER THAN THE PLATE ITSELF

Hydrostatic tension, torsion, and bend tests impossible with any other type of conduit, have proved that the Biggs weld is stronger than the plate itself.

Work with Biggs on Your Very Next Pipe Project

Biggs Pipe, together with Biggs' years of experience not only in building pipe, but in its actual installation on many important municipal contracts, enables us to render unusual service to the contractor using our products. Having been "on your side of the fence," we know the contracting difficulties encountered in installing large diameter pipe.

Proper shop fabrication, close attention to such details as designing and laying out special sections, and locating field joints at the most advantageous points, have an important bearing on your cost of installing steel pipe. Biggs assumes responsibility for all such details.

Biggs Electrically Welded Pipe offers maximum structural strength (100% joint efficiency), a smooth interior, a practical absence of maintenance, complete uniformity and dependability. It assures a safe, permanent, economical, efficient pipe line, especially suitable where operating conditions are severe.

Why not let Biggs work with you on the next pipe in your territory?

BIGGS BUILDS

Welded Steel Pipe	Tunnel Shields
Riveted Steel Pipe	Air Locks
Pontoons	Welded Tanks
Caissons	Riveted Tanks

Steel Plate Construction of Every Description

THE BIGGS BOILER WORKS COMPANY

AKRON, OHIO New York Detroit

Biggs 20-inch electrically welded steel pipe being installed in downtown Cleveland on an important high pressure distributing line. Electrically welded steel pipe, with its superior structural strength and maximum carrying capacity, is preferred by leading water works engineers. This view is taken from Biggs' interesting photographic folder, "Unusual Steel Plate Construction," a copy of which will be gladly mailed you.

PORTER

PORTABLE HAND OPERATED

CUTTING TOOLS

Combining the power multiplication principles of the lever and toggle joint to produce an extremely efficient two hand cutting device with a variety of jaws to perform various kinds of work. The Porter line embraces 60 models and sizes — all portable requiring no bench or support and with work capacities far beyond any other type of quick action portable hand operated cutting tool.

The illustration at the upper left shows the standard Porter Bolt Clipper — a tool in general use for nearly half a century, for cutting bolts and soft rods. The maximum capacity of the largest bolt clipper is 3-4 inch annealed bolt in the thread or 5-8 inch soft rod.

On the right is a modified form of the original tool with jaws designed for splitting nuts. This tool in the largest size will split the nut of a 3-4 inch bolt. Invaluable in removing nut which for any reason cannot be turned or removed with a wrench.

Porter Tools are sold by nearly all the leading jobbers and mill supply houses everywhere. Write for illustrated catalog or ask your jobber.

H.K. PORTER INC.

38 Ashland Street

EVERETT MASS.

FOUR BIG Ransome MIXERS for SAFE HARBOR DAM

WHEN the Arundel Corporation of Baltimore needed mixers for the big dam across the Susquehanna at Safe Harbor, Pa., they selected four No. 56-S Ransome Standard Building Mixers for the job.

A *big* engineering undertaking — calling for *big* mixers! The dam will be approximately one mile long and 65 feet high.

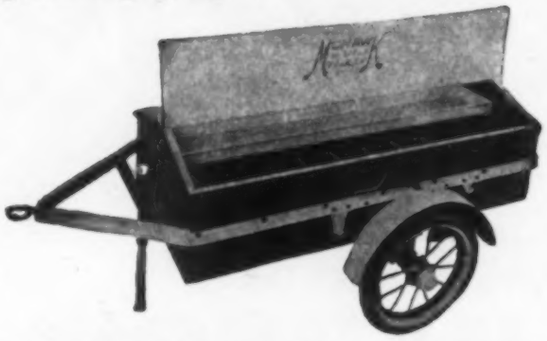
When *you* buy Ransome Big Mixers for *your* big jobs, you have the certainty of maximum output combined with minimum delays. Remember the mixer is the heart of the job when concrete is being placed. The simpler and sturdier it is, the greater your insurance against mixer delays.

Ransome Big Mixers are outstanding in simplicity and sturdiness. Write for Bulletin 122.

Ransome Concrete Machinery Company
1850 — Service for 80 Years — 1930
Dunellen **New Jersey**

MOHAWK HI-SPEED TRAILER
TRADE-MARK

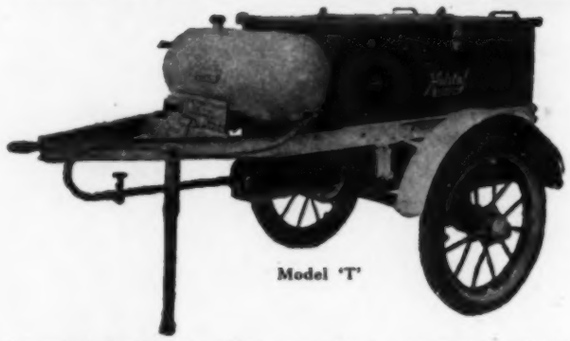
All steel Mohawk Trailers quickly pay for themselves



All steel Mohawk Trailers are designed to meet exacting requirements of construction companies, contractors, engineers and public utilities. Tool compartments for large tools with sliding trays for small tools. Shelves and special fastenings accommodate special tools and supplies. All steel Mohawk Hi-Speed Trailer Tool Boxes quickly pay for themselves through eliminating tool losses and labor delays. Make every job a profitable job by speeding up your work. Made in 6, 7 and 8 foot lengths. Made of the finest materials and expertly constructed.

Hotstuf
TRADE MARK

Reload with cold material without cooling the hotstuff



Model 'T'

The patented elevated melting chamber in the Hotstuf Heater is separated from the lower storage chamber by a solid removable partition plate with an opening at the bottom. Plate is easily removed for cleaning. The cold material is distinctly separated from the hotstuff and makes it possible to reload with cold material without cooling the hotstuff. At least 30% greater melting capacity with 30% less fuel over any other heater on the market. Hotstuf Heaters are made in 25, 50, 75 and 100 gallon capacities. Portable or stationary.

Write today for Catalog describing Hotstuf Heaters, Mohawk Trailers, Combination Tool and Asphalt Heaters, Heating Pans, Paving Tools.

MOHAWK ASPHALT HEATER CO.

62 Weaver St., Schenectady, N. Y.

DEPENDABILITY

A New York subway contractor was using a Moretrench Wellpoint System. The party who asked him how he liked it got a short answer:

"IT DOES THE WORK—WHAT MORE CAN I SAY?"

The Moretrench Wellpoint System was put on that job to get the water out and to keep it out. It was doing it. What more could be said? "IT DOES THE WORK."

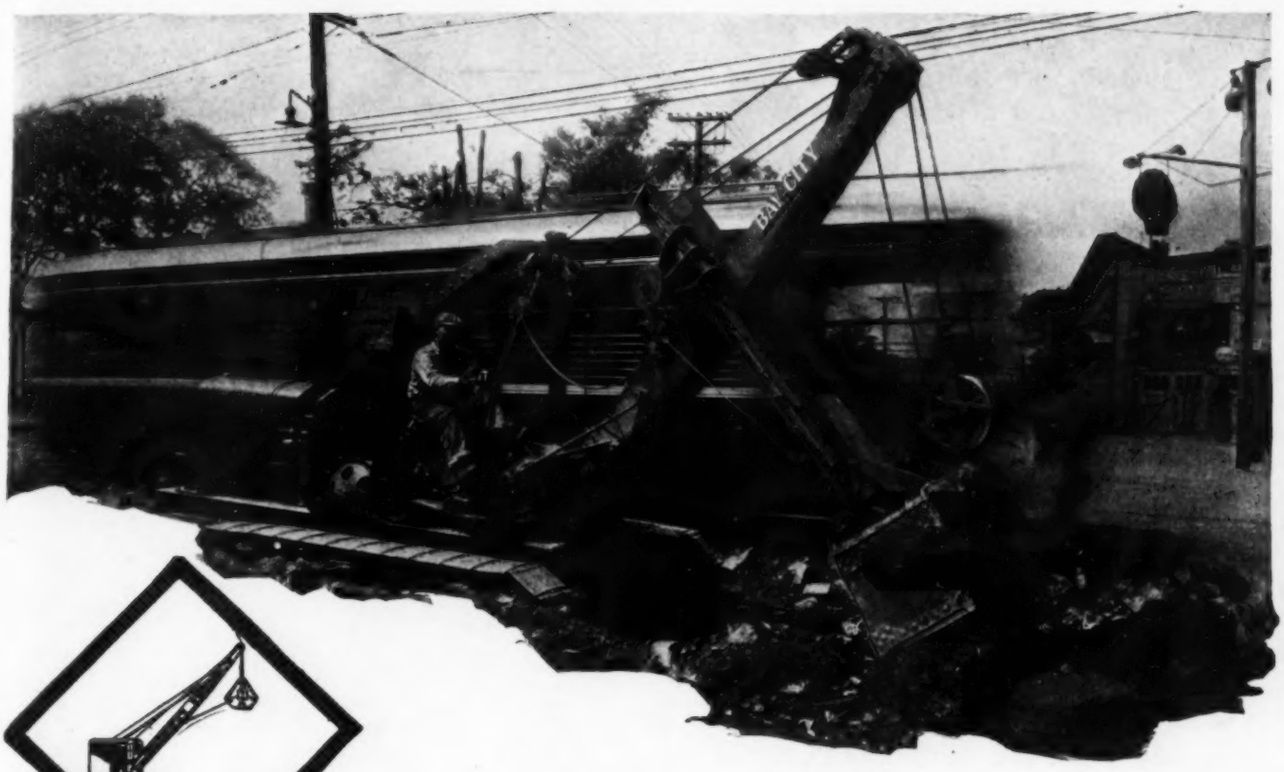
When you use this system the only water you see is at the end of the pump discharge. No sumps—no drains—no tin pail bailing. Often no sheeting—room to do things and time to do them right.

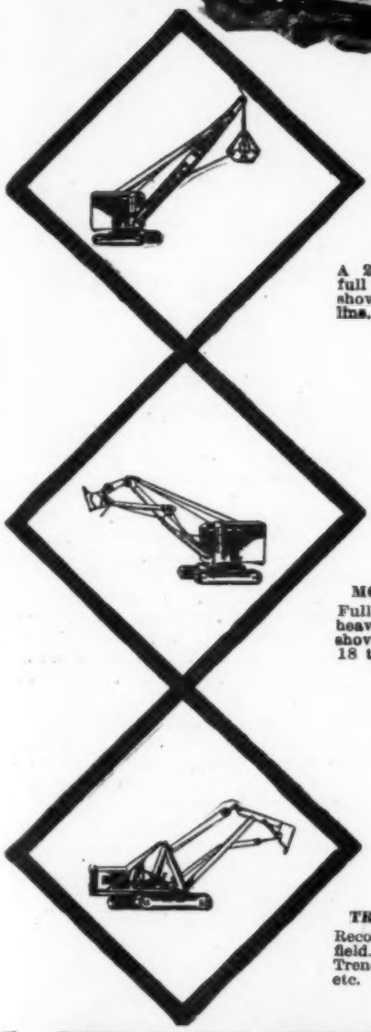
Costs you more to start with—that comes back quickly with interest. Thousands of wet jobs made dry have proved it.

Tell us what you have—we will give you our answer and the price.

The Moretrench Wellpoint System makes every job a dry job.

Moretrench
MOORE TRENCH MACHINE CO. *Rockaway, N. J.*
CONVEYING EXCAVATORS
WELLPOINT SYSTEM





MODEL B
A 26-ton, heavy duty, full revolving ¾-yd. shovel, crane or dragline.

MODEL K AND K-2
Full revolving light or heavy ½-yd. convertible shovel. Weighs 14½ or 18 tons.

TRACTOR SHOVEL
Recognized leader in its field. Operates shovel, Trench hoe, backfiller, etc. Weighs 10 tons.

Doing the unusual—as usual!

BAY-CITY shovels are not specially designed for the unusual operation, but their versatility, their utility and their downright ability to handle any job within their range, as well as ordinary excavating and grading, make them "king-pin" in any contractor's stock of equipment.

The Tractor-Shovel shown here, equipped with short boom, is doing the *unusual* for Eastern Contracting Co., Brooklyn, N. Y. —breaking up concrete between ties and loading chunks of concrete and old ties into trucks. Right down in the trolley road bed, the Tractor-Shovel keeps going—averaging 125 feet an hour. Yes, and trolley service keeps going, too, without delay, without interruption.

No overhang, ¾ circle swing, reserve power, convertible buckets, roller and ball bearings on high speed shafts, 3 travel speeds and easily handled.

Use it for small jobs or large jobs; use it as a "clean-up" machine; use it in place of hand labor. It's a "Lilliputian Giant" with a thousand uses—just watch it in action and be convinced, or write us for further particulars.

BAY CITY SHOVELS, Inc.

New York Office—302 Broadway **BAY CITY, MICH.**

BAY-CITY SHOVELS

THE BAY-CITY FAMILY OF FAST WORKERS

Answers to your problems in structural engineering always at your finger tips

This special offer saves you $7.00

We are offering with the Hool and Kinne Library a free copy of Dingman's Estimating Building Costs. In addition we have made the terms easier. Our offer gives you $34.50 worth of books for only $27.50.

Hool and Kinne's

Structural Engineers' Handbook Library

6 Volumes—3575 pages—fully illustrated

EVERY man concerned with the design and construction of civil engineering structures of any type should have these practical books with their helpful tables, diagrams, reference data, best methods and details.

The Hool and Kinne Library covers every phase of structural engineering from foundation and substructure work to the completed erection. The treatment of each topic is practical, thorough and authoritative.

Every one of the six volumes is jammed to the covers with sound practical information drawn from the records of actual practice.

Never before has such a large staff of well known structural engineering specialists collaborated to produce a work of this kind. Much of the material has never before been available in book form. All of it is based on the experience and records of actual practice.

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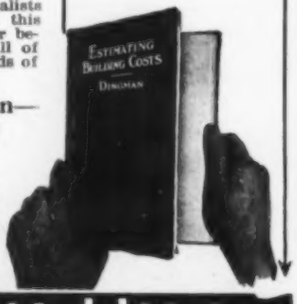
A special low price—reduced monthly payments

Send the coupon and see these books for 10 days free. If they do not seem to be worth many times the 14 cents a day they cost, send them back. You get $34.50 worth of books for $27.50 on small payments. And they are really great, helpful books that you can use to advantage.

Mail this Coupon—TODAY!

FREE if you act NOW!

Dingman's Estimating Building Costs which we are offering free with the Hool and Kinne Library, is a practical, handy size handbook, explaining the principles and methods of estimating building construction costs. It is packed with data that you can use in your daily work.



McGRAW-HILL FREE EXAMINATION COUPON

McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York.

You may send me **Hool and Kinne's Structural Engineers' Handbook Library,** for my inspection. If the books prove satisfactory I will send $3.50 in 10 days and $3.00 per month until I have paid the price of the books, $27.50. If the books are not what I want, I agree to return them within 10 days of receipt. Upon receipt of my first payment you are to send me a free copy of Dingman's Estimating Building Costs.

Signature .....

Home Address .....

City and State .....

Name of Company .....

Occupation .....

(To insure prompt shipment write plainly and fill in all lines.)

C.M.9-30

Lectro molded BOOT

Short Height

An entirely new and more practical boot for excavation work

Molded in one piece like an automobile tire

Storm King Height

Also made in Sporting Height

The Lectro Molded Boot is built by an entirely new patented method that produces the toughest, longest wearing and most comfortable fitting boot ever designed. Under terrific pressure the boot is molded in one piece so compact and solid that it will stand more grinding, cutting, and hard wear than any ordinary rubber boot.

Lectro Molded Boots are made only by the Hood Rubber Company, Inc., who manufacture a complete line of quality rubber footwear for all industrial uses.

If your supply house cannot supply you with Lectro Molded Boots write to the Hood Rubber Company, Inc., Watertown, Mass. Without any obligation at all we will gladly mail you a folder which fully describes the interesting features of this new product.

The Lectro Molded Boot is patented and made only by

HOOD RUBBER COMPANY, INC.

Watertown, Mass.

HOOD MAKES CANVAS SHOES · RUBBER FOOTWEAR · TIRES
RUBBER SOLES AND HEELS · RUBBER FLOOR TILING

PUNCHING PILING DOWN

For PULLING Piles

This is the Vulcan Pile *Extractor*, the economical tool built exclusively for pulling piling. Always ready, easy to handle, pulls longest, heaviest piles. Saves the inconvenience of inverting costly hammers for pulling purposes.

Real punching action accurately describes the way the Warrington-Vulcan Pile Hammer applies the driving energy to piling.

There is no wasted energy. The Warrington-Vulcan punching action gets the very maximum of penetration at each blow. The work is, therefore, speeded. Driving costs per pile are lowered.

This correct punching action is due to the Warrington-Vulcan principle embodied only in these pile hammers,—"a low velocity blow from a heavy mass of ram."

Long satisfactory service is assured when you own a Warrington-Vulcan Pile Hammer. After years and years in service, not one has ever completely worn out.

VULCAN IRON WORKS

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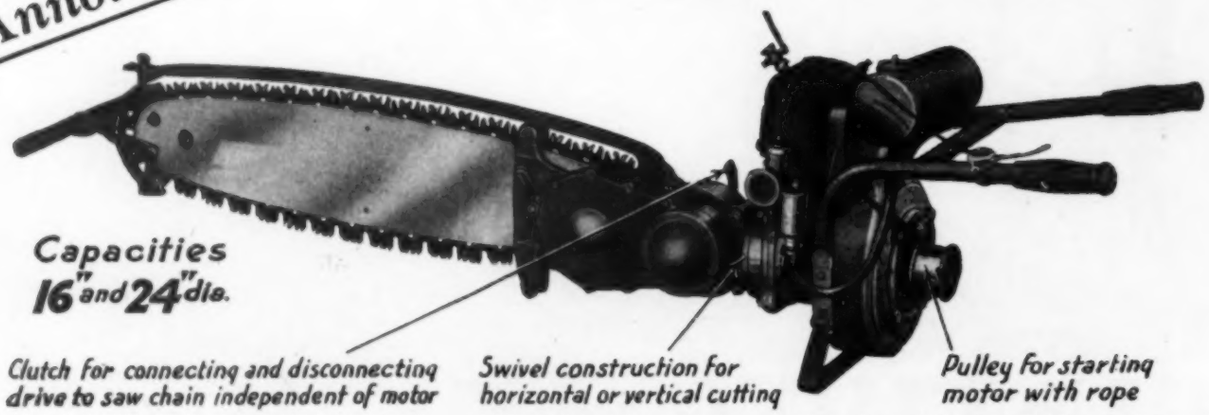
Woodward, Wight & Co., Ltd., 451 Howard Avenue, New Orleans, La.
Representatives for the State of Washington:
A. H. Cox & Co., 1757 First Ave., South, Seattle, Wash.

WARRINGTON VULCAN

Announcing . . .

THE *GASOLINE* ENGINE DRIVEN "WOLF" Portable Timber Sawing Machine


Capacities
16" and 24" dia.
Clutch for connecting and disconnecting drive to saw chain independent of motor
Swivel construction for horizontal or vertical cutting
Pulley for starting motor with rope

4 H.P. air cooled type. Chain, saw frame and drive units same as furnished with "WOLF" electric and air drive machines, over 450 of which are in use.

Suitable for cutting heavy timber—for felling and bucking trees and specially adapted for cutting pulp wood.

Thoroughly tested and tried—with efficiency equal to that of electric or air outfits (20-in. dia. Elm cut in 55 secs., 8-10-in. dia. green Birch 5 secs.).

Send for bulletin.

REED-PRENTICE CORPORATION, Worcester, Mass., U. S. A.

Specifications

Length overall	21½"
Weight	32 lbs.
Bore and Stroke	2⅝"x2⅜"

Air Pressure Recommended: 70 to 80 lbs. gage

Two H6's can be run from a compressor of 100 to 120 cubic ft. capacity.

CLEVELAND

H6

It CHALLENGES

a Heavy Sinker

A light sinker with all the advantages of a heavy tool. One that drills fast, rotates the steel, blows the hole. That's the new Cleveland H6!

Speed that challenges a heavier sinker, with stamina as great. It stays on the job.

With a Cleveland H6 on your property it isn't necessary to use a heavy drill. For pop-holing or for other drilling to depths of ten feet or more.

Under such conditions it is obvious that there is a reduction in costs that merits consideration.

We'll be glad to demonstrate the Cleveland H6 at your convenience. Write.

***The* CLEVELAND ROCK DRILL CO.**

3734 E. 78th St.
CLEVELAND, OHIO

Another WILEY-WHIRLEY Advantage . . .

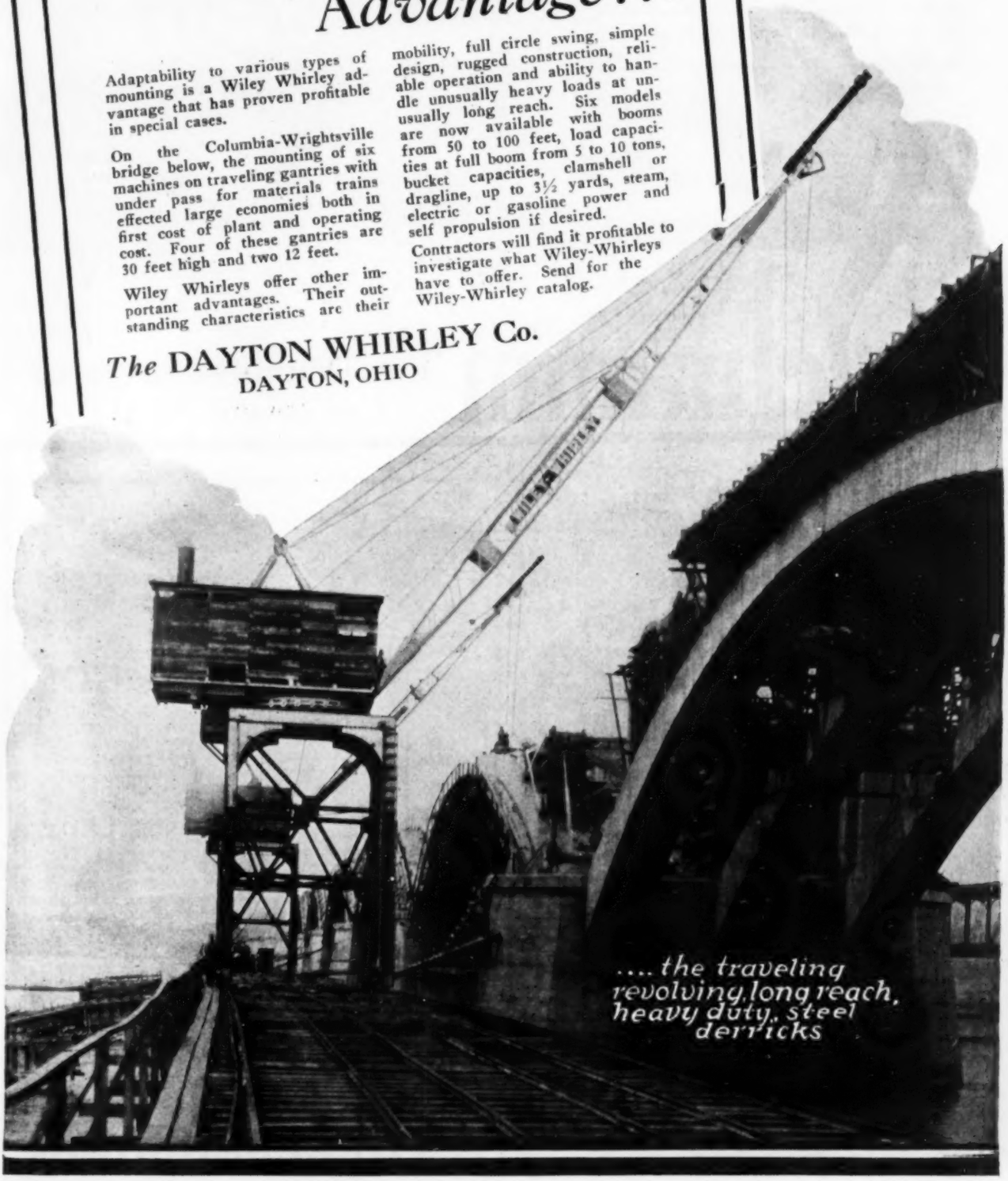
Adaptability to various types of mounting is a Wiley Whirley advantage that has proven profitable in special cases.

On the Columbia-Wrightsville bridge below, the mounting of six machines on traveling gantries with under pass for materials trains effected large economies both in first cost of plant and operating cost. Four of these gantries are 30 feet high and two 12 feet.

Wiley Whirleys offer other important advantages. Their outstanding characteristics are their mobility, full circle swing, simple design, rugged construction, reliable operation and ability to handle unusually heavy loads at unusually long reach. Six models are now available with booms from 50 to 100 feet, load capacities at full boom from 5 to 10 tons, bucket capacities, clamshell or dragline, up to 3½ yards, steam, electric or gasoline power and self propulsion if desired.

Contractors will find it profitable to investigate what Wiley-Whirleys have to offer. Send for the Wiley-Whirley catalog.

The DAYTON WHIRLEY Co.
DAYTON, OHIO



120 cu.ft. portable Engine Driven Compressor on Steel Wheels.

Portable Air COMPRESSORS

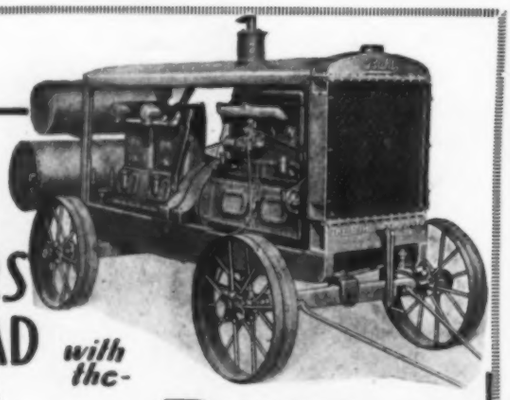
Schramm Compressors are adaptable to any kind of a job where air tools are employed.

The facility of movement from place to place is the result of determined study of the mounts—either a truck chassis or trailer type.

But there is also a Schramm compressor designed for any job—from 1 to 360 cu.ft. displacement per minute.

Representatives in all important cities have stocks on hand.

Schramm Inc., Manufacturers
West Chester, Penna.



Get YEARS AHEAD with the-

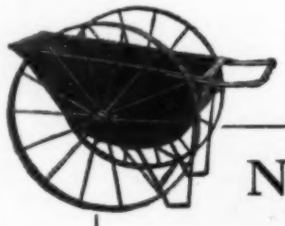
BUHL
PORTABLE AIR COMPRESSOR

The many advanced features obtainable only in the *Buhl* result in lowest possible cost of air and greatest freedom from annoying and costly shutdowns.

Buhl Portable Compressors are made in 36, 55, 90, 110, 220 and 330 cu.ft. capacities.

Get the facts about the *Buhl* before deciding on your next compressor. **Please address**

The *Buhl* Company
Old Colony Bldg.,
CHICAGO



Now— Let's GO!

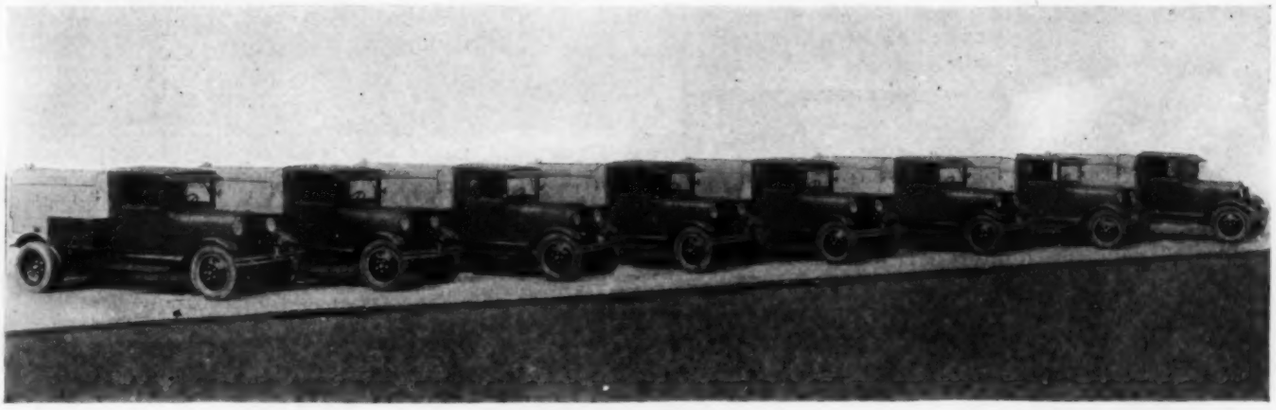
Better times are ahead—already there are signs of returning confidence all along the line. And confidence, backed by earnest, purposeful effort, is all that is needed now to give steadily increasing momentum to the wheels of industry and trade. Intelligent buying and elimination of waste will give a new and firmer basis for profitable operations at lower costs. And speaking of lower costs—remember, when you're buying wheelbarrows, carts or scrapers, that Bull Frog products give longer, steadier service—more work per man. Ask your jobber or supply house, or send for catalog of the complete Bull Frog line.

THE TOLEDO WHEELBARROW CO.
Toledo, Ohio
Branch Office and Warehouse:
CHICAGO—520 West Erie St.

BULL FROG WHEELBARROWS

METALWELD-WORTHINGTON

"A Great Name in the Portable Field"



Above view shows one battery of a great fleet of METALWELD-WORTHINGTON Portable Compressors owned by a large eastern utility company.

The first order for "AIR KINGS" from this large utility company was small—one unit,—then two. These were subjected to impartial, cold-blooded working tests against the entire field. The verdict of "Excellence" was passed and the small order grew to a vast fleet of METALWELD-WORTHINGTON "AIR KINGS."

This actual proof of *quality* is the more convincing because the user is a leading public utility whose operating costs are minutely analyzed and whose contracts are based on an inflexible time limit. No hope for questionable equipment there! Demonstrated superiority, which really means long-run economy, influenced this great utility company to purchase more and more "AIR KINGS."

Send for our New Catalogue!

METALWELD, Inc., 26th and Hunting Park Ave., Philadelphia, Pa.

Dealers in principal cities.

METALWELD WORTHINGTON
AIR KING
Portable Air Compressors

"AIR KING" Features

No. 1—Lubrication that is *truly* Full Force Feed

The term "Full" as applied to Full Force Feed Lubrication has been grossly abused. Forcing oil to the main crankshaft and connecting rod bearings is Force Feed Lubrication, but it is NOT Full Force Feed Lubrication.

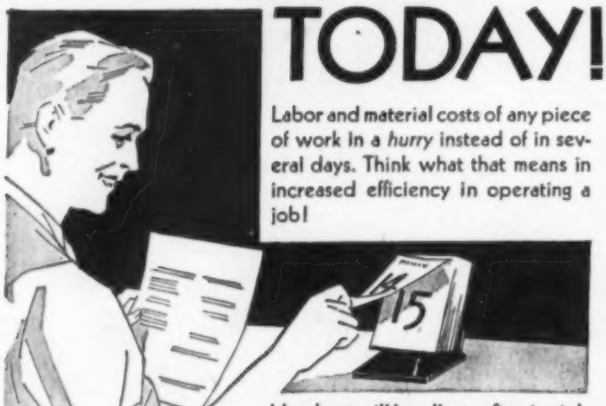
In the METALWELD-WORTHINGTON "AIR KING" Portable Air Compressor oil is forced under 30 lbs. pressure not only to all main and connecting rod bearings, but ALSO through the rifle-drilled connecting rods to the wrist pins and wrist pin bearings. This is truly FULL FORCE FEED LUBRICATION.

Be sure to specify *Full* Force Feed Lubrication on your next order, and to make sure that you get it, insist on the "AIR KING."

METALWELD-WORTHINGTON

PORTABLE AIR COMPRESSORS

YESTERDAY'S COSTS TODAY!



Labor and material costs of any piece of work in a *hurry* instead of in several days. Think what that means in increased efficiency in operating a job!

Marchant will handle any figuring job in less time...any time...every time. Lightens work...and overhead. Figures estimates, costs, payrolls, reports, job records...*anything*...in 25% to 40% less time, without the brain fagging, nerve destroying rush! rush! rush! of old fashioned hand methods.

Right the first time. No need to refigure or check back.

Adds
Subtracts
Multiplies
Divides

MARCHANT PORTABLE *Calculator* $125

Anyone can run it.
Portable compact. Figures on the job, in camp or in the office. Gives years of satisfactory high-speed service.
Sold under the standard Marchant guarantee. Terms if desired.
Start yourself on the road to quick easy accurate figuring by mailing the coupon NOW!

17 years building calculators, nothing else . . Electric, hand operated and portable models . . as low as $125.

Free! Marchant Calculating Machine Co. MAR-068
Dept. 177, Oakland, California
Please send me free booklet and full information about
☐ Marchant 100% Electric ☐ $125 Marchant Portable

Name_____
Firm_____
Address_____
City and State_____

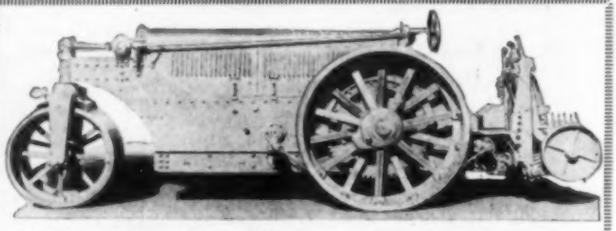
Economical Manufacturing—Better Engineering—Universal Service

QUANTITY production is generally better and cheaper, and a machine widely used must be trouble-proof. It is for these reasons that Brookville Locomotives are powered by the best known engines in the world—Ford AA for the light models; Fordson and McCormick-Deering for the heavier models.

The Brookville Locomotive chassis itself is so simple and rugged that nothing less than serious accident can disable it; and the Brookville Reverse provides proper speed reduction from the standard transmission which accompanies the motor, making all forward speeds available in reverse.

Send for Literature.

BROOKVILLE LOCOMOTIVE CO.
BROOKVILLE, PA.



Rugged-Reliable-Modern

That the Buffalo-Springfield Roller really has extra years of service built into it is a fact that becomes readily apparent upon close inspection. Nothing that specialized manufacture considers desirable, or that the most exacting buyer demands, is lacking.

Aside from the incorporation of the latest worthwhile features, these rollers are fabricated with strength, ruggedness, and in consequence, with long life ever in mind as a major consideration.

Built in every practical weight and size, steam and motor driven, three wheel and tandem. Scarifier and other attachments optional.

Write for illustrated booklet.

The Buffalo-Springfield Roller Co.
Springfield, Ohio

Buffalo-Springfield ROLLERS

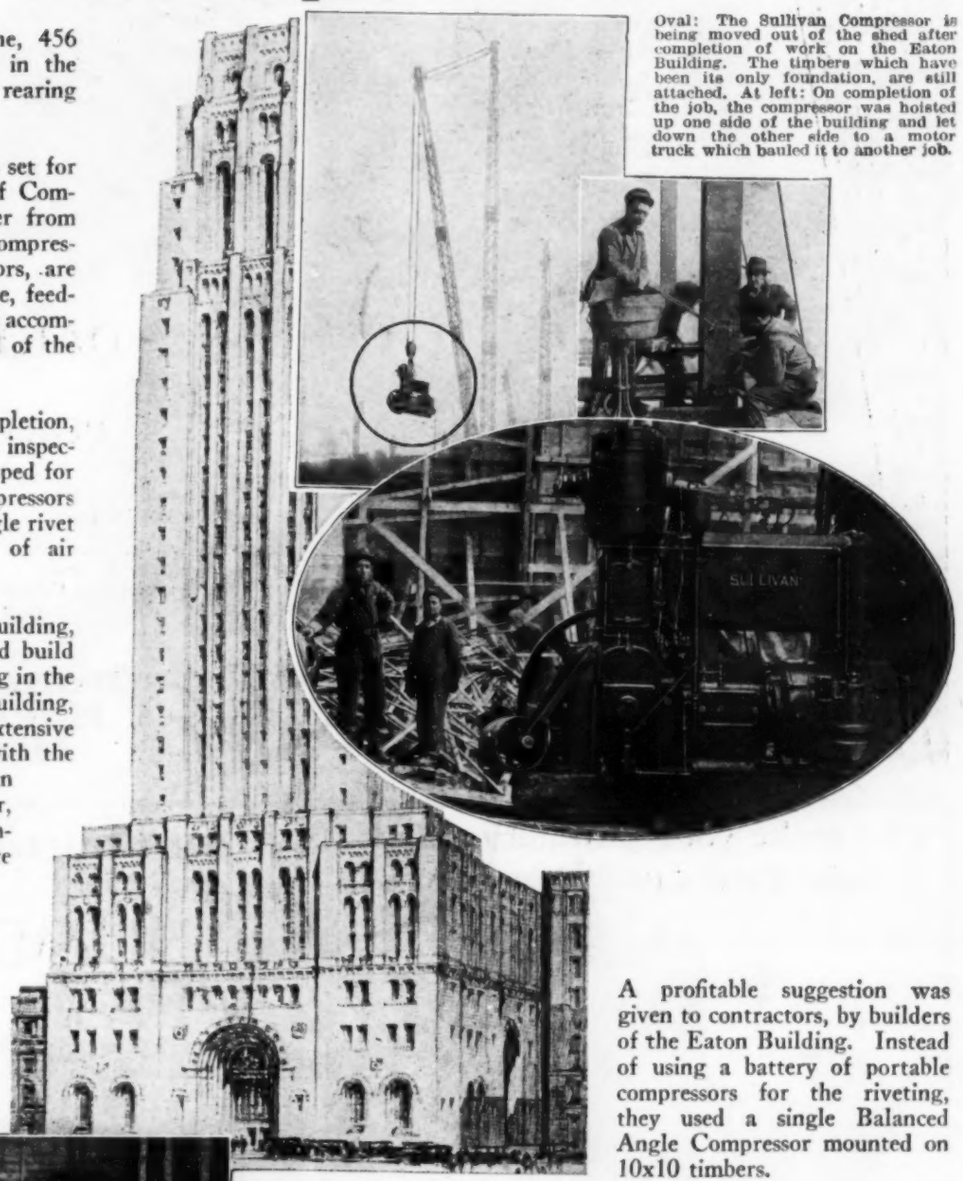
Building a greater Toronto with Compressed Air

INTO the Toronto skyline, 456 feet, the tallest building in the British Empire is now rearing its head.

Nearly 200,000 rivets will be set for the 34 stories of the Bank of Commerce Building—by air power from two Sullivan Vibrationless Compressors. Two 220-ft. compressors, are connected by a 2-inch pipe line, feeding a large air receiver, which accommodates the irregular demand of the riveting guns.

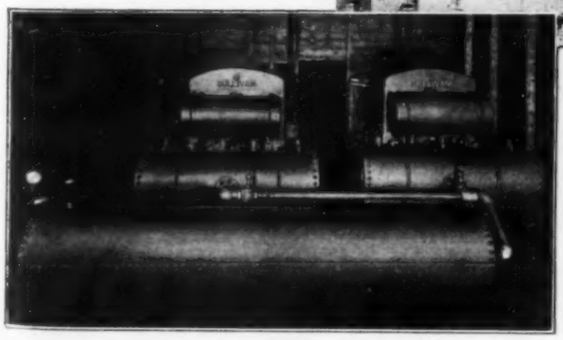
As the building nears completion, James Carr, the general steel inspector, says, "We have never stopped for air since the Sullivan Compressors went on the job; and not a single rivet has been cut out for want of air pressure."

In addition to the tallest building, Sullivan Air Power has helped build in Toronto, the largest building in the Empire. This is the Eaton Building, covering four city blocks. Extensive caisson work in connection with the foundation, employed a Sullivan Balanced Angle Compressor, two single stage Sullivan Compressors, and Sullivan concrete breakers, and clay diggers.



Oval: The Sullivan Compressor is being moved out of the shed after completion of work on the Eaton Building. The timbers which have been its only foundation, are still attached. At left: On completion of the job, the compressor was hoisted up one side of the building and let down the other side to a motor truck which hauled it to another job.

New Bank of Commerce Building now being constructed in Toronto. Nearly 200,000 rivets will be set with air power from the Sullivan vibrationless compressors shown at the left.



Note the 2-in. pipe line connecting the Sullivan compressors. The picture was a 2-minute exposure taken while both machines were running, loading and unloading. Are Sullivan compressors vibrationless?

A profitable suggestion was given to contractors, by builders of the Eaton Building. Instead of using a battery of portable compressors for the riveting, they used a single Balanced Angle Compressor mounted on 10x10 timbers.

Buildings, roads, sewers, water mains, and other construction enterprises in Toronto, are being speeded up with Sullivan air power equipment.

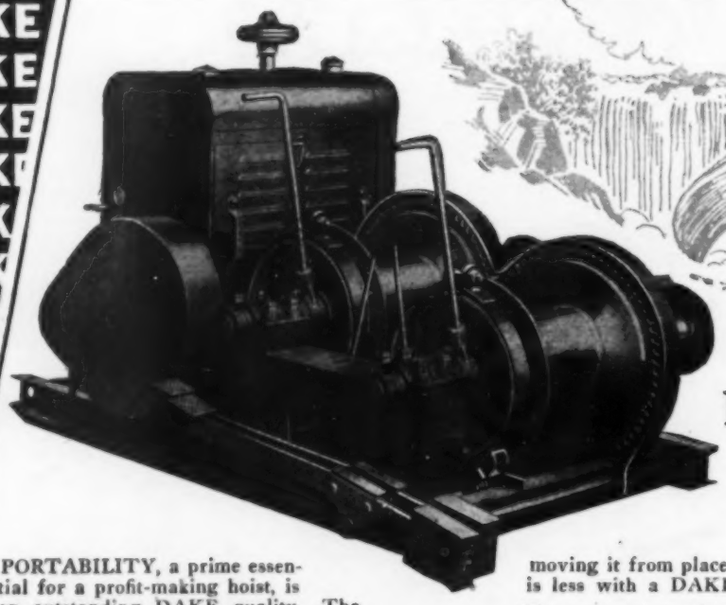
Why not send for the picture book "Speed Up With Air."

SULLIVAN AIR POWER EQUIPMENT

Sullivan Machinery Company
404 N. Michigan Ave., Chicago
30 Church St., New York

HOISTS BUILT ESPECIALLY FOR CONTRACTORS

DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE



DAKE HOISTS *for* PORTABILITY

PORTABILITY, a prime essential for a profit-making hoist, is an outstanding DAKE quality. The electric-welded *steel* frame and driving drum provide great strength coupled with unusual lightness of weight.

The initial cost—the operating cost—the cost of moving it from place to place, on and off the job—is less with a DAKE hoist.

There are many other features of DAKE HOISTS which are helpful to contractors looking for greater profits. Investigate DAKE HOISTS, either gasoline or electric, from 2 to 27 H.P. $250 to $1,900 F.O.B.

DAKE ENGINE COMPANY Grand Haven Michigan

DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE DAKE

To make your unwatering and water supply problems easier!

THIS Morris Portable All-Purpose Pump handles anything from clear water to floating dirt, sand and gravel, delivers 300 to 600 gals. per min., can be used for heads up to 50 ft., and is easy to cart from one job to another. For general water supply, unwatering excavations, sumps, etc., it can't be beat.

Write for literature about this and other sizes of Morris Pumps

MORRIS MACHINE WORKS, Baldwinsville, N. Y.

MORRIS CENTRIFUGAL PUMPS

Man, how they lift water!

These

HUMDINGER

SELF-PRIMING CENTRIFUGAL PUMPS

Two Humdingers (the four and the six-inch) working on a regular open-ditch drainage job, pulling water, mud and sand up a 22-foot suction lift. No priming pumps, no complicated parts, nothing to get out of order. Humdingers come in 5 different sizes. 100 to 1500 GPM.

Ralph B. Carter Co., Hackensack, N. J.

28 Days SAVED

$1,400 BONUS EARNED

SOUTH SALINA STREET is one of the most heavily-traveled thoroughfares in Syracuse, N. Y. When the paving contract was let, recently, a penalty and bonus clause of $50.00 a day was incorporated and a time limit of 80 days established. "INCOR" Cement was used . . . 28 days were saved . . . $1,400 bonus was earned.

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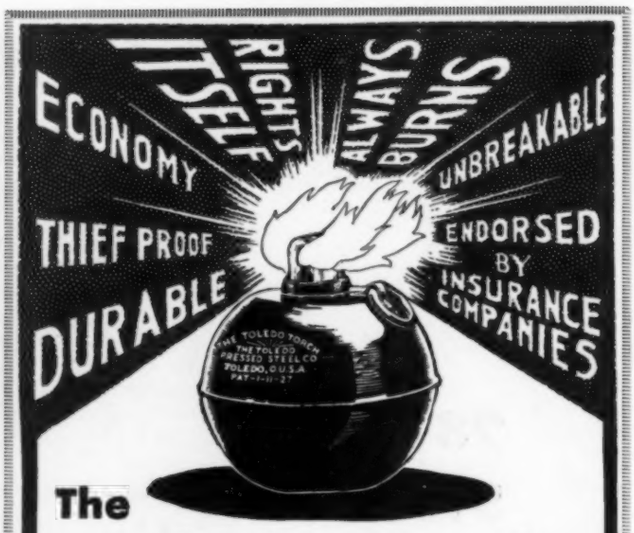

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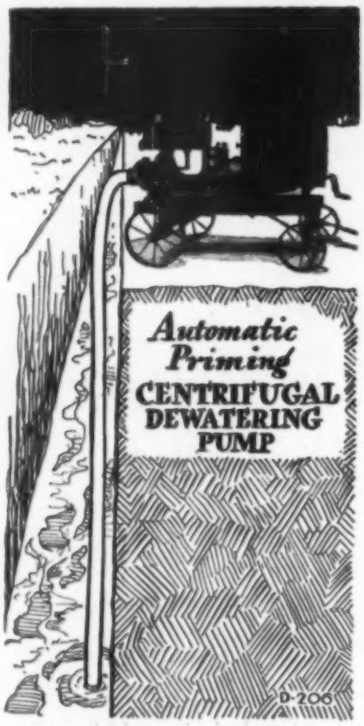

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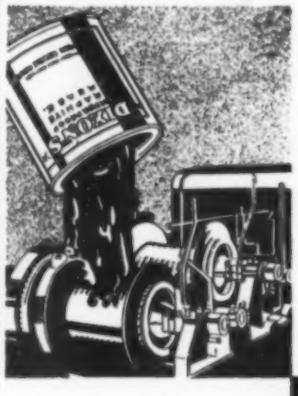

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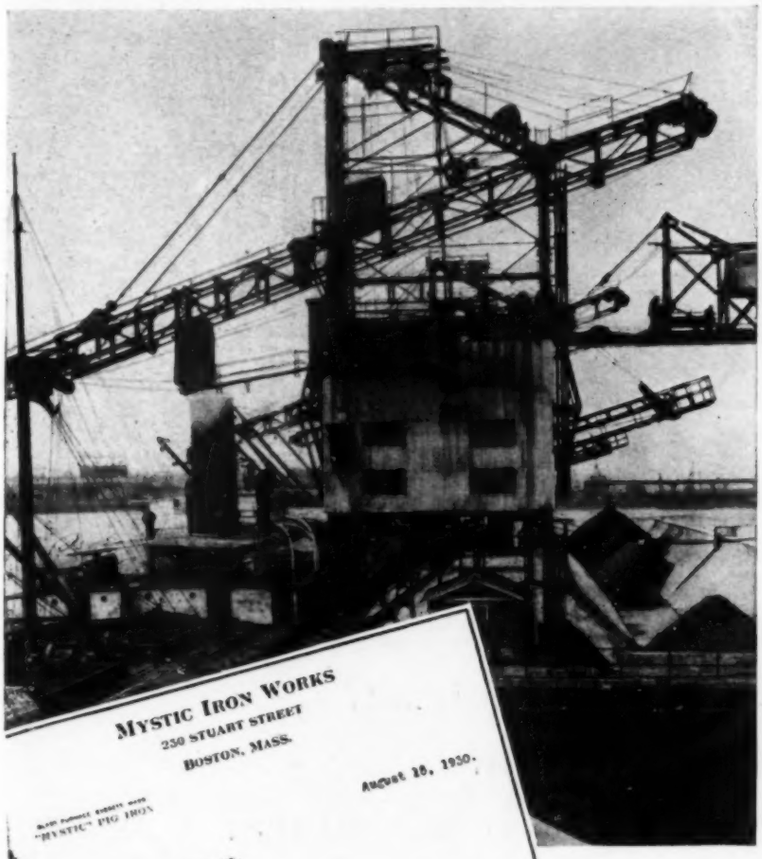

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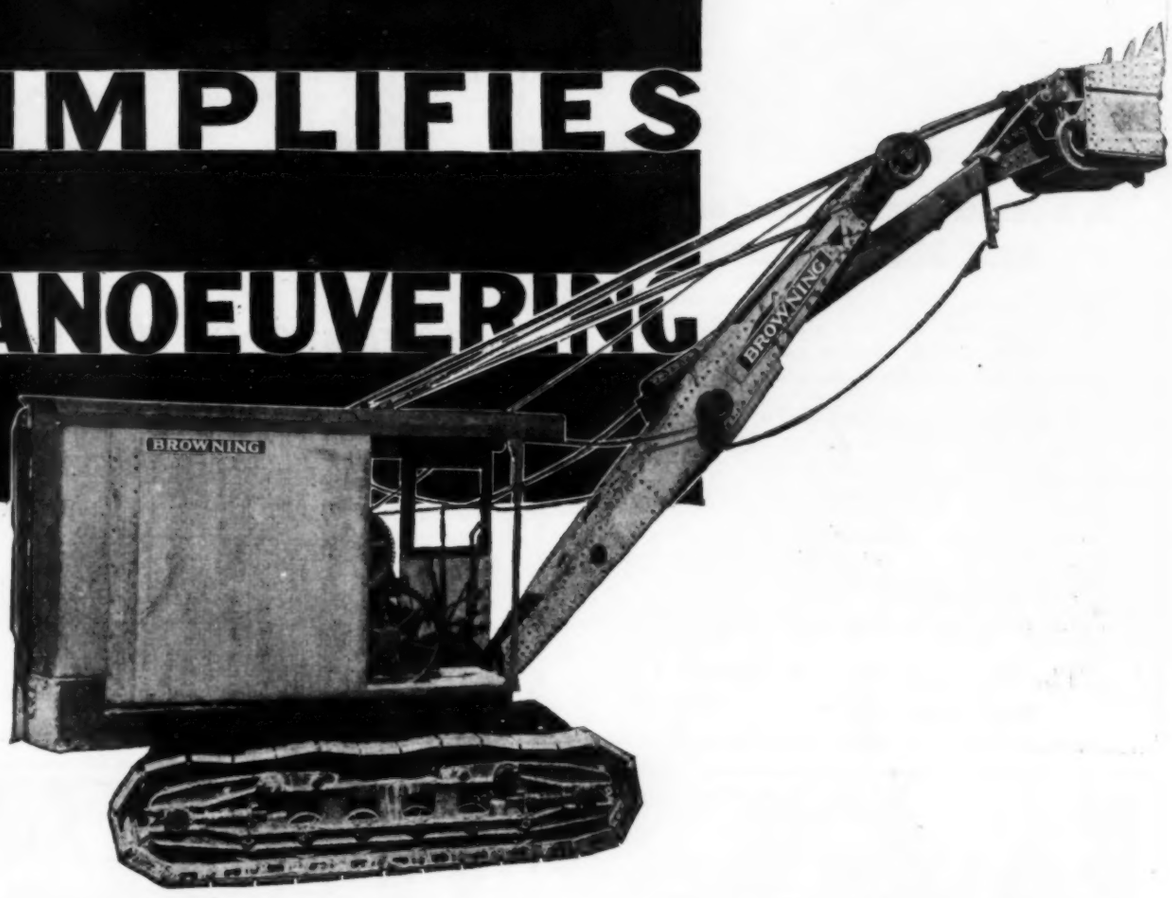

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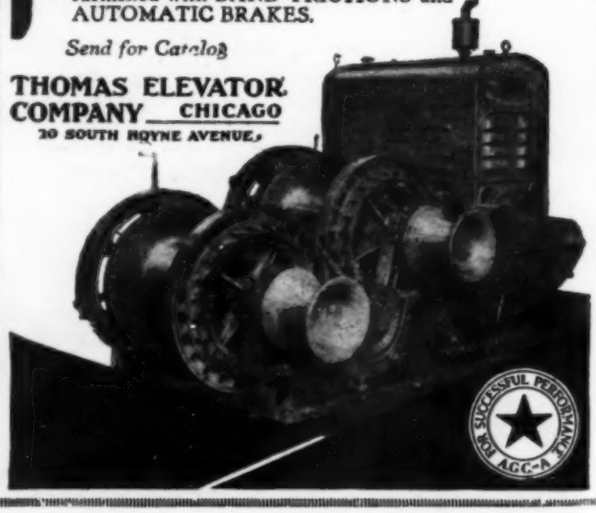

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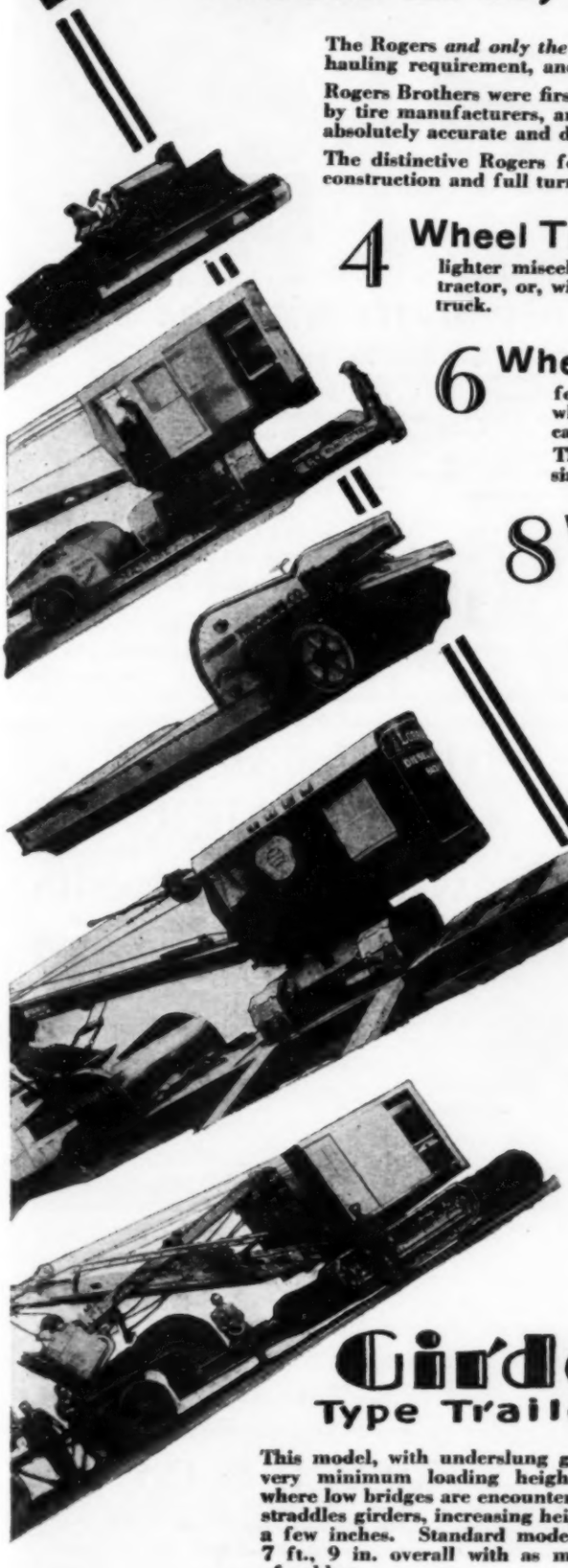

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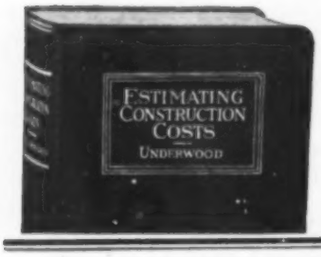

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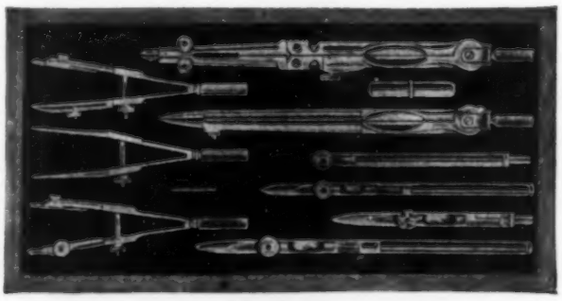

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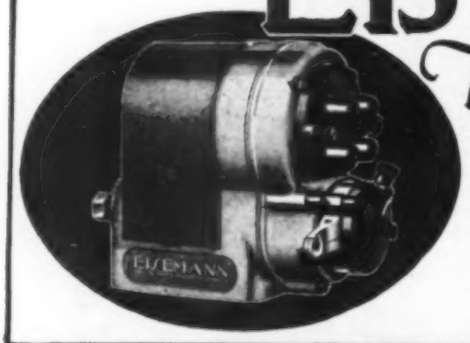

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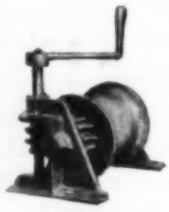

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